SEL

INSTRUCTION MANUAL

7580

ELECTRONIC COUNTER

DANA®

PUBLICATION NO. 980476

7580
ELECTRONIC COUNTER

(INCLUDES 7580C)

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Before undertaking any maintenance procedure, whether it be a specific troubleshooting or maintenance procedure described herein or an exploratory procedure aimed at determining whether there has been a malfunction, read the applicable section of this manual and note carefully the WARNING and CAUTION notices contained therein.

The equipment described in this manual contains voltages hazardous to human life and safety and which is capable of inflicting personal injury. The cautionary and warning notes are included in this manual to alert operator and maintenance personnel to the electrical hazards and thus prevent personal injury and damage to equipment.

If this instrument is to be powered from the AC Mains through an autotransformer (such as a Variac or equivalent) ensure that the instrument common connector is connected to the ground (earth) connection of the power mains.

Before operating the unit ensure that the protective conductor (green wire) is connected to the ground (earth) protective conductor of the power outlet. Do not defeat the protective feature of the third protective conductor in the power cord by using a two conductor extension cord or a three-prong/two-prong adapter.

Maintenance and calibration procedures contained in this manual sometimes call for operation of the unit with power applied and protective covers removed. Read the procedures carefully and heed Warnings to avoid "live" circuit points to ensure your personal safety.

Before operating this instrument.

1. Ensure that the instrument is configured to operate on the voltage available at the power source. See Installation section.
2. Ensure that the proper fuse is in place in the instrument for the power source on which the instrument is to be operated.
3. Ensure that all other devices connected to or in proximity to this instrument are properly grounded or connected to the protective third-wire earth ground.

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SECTION 1 GENERAL DESCRIPTION

1.1 GENERAL.

1.2 The Dana Model 7580 is a ruggedly constructed, compact electronic counter with the accuracy and sensitivity necessary for both field and bench operation. The instrument measures frequencies as high as 1 GHz to seven places with voltage levels as low as 10 millivolts.

1.3 The counter is completely self contained and, with the high sensitivity of the input, no preamplification is normally required. Leading zero blanking simplifies reading of the display. A built-in "kickstand" makes the display easier to view and provides easier access to the controls during bench work. A built-in circuitry check verifies proper instrument operation even while the meter is connected to other circuitry.

1.4 Frequency inputs from 20 Hz to 200 MHz are applied to the instrument through a standard BNC connector at an input impedance of 1 Megohm in parallel with 25 picofarads. A manual control permits measurements of RMS input levels from 50 millivolts to as high as 250 volts with no damage to the input circuitry.

1.5 Frequencies from 100 MHz to 1 GHz are applied to a 50Ω input impedance BNC connector. An automatic gain control circuit automatically adjusts for the level of the input for RMS inputs of 1 volt maximum to as low as 10 millivolts. A special IN-RANGE light, above the input connector, lights when the input is of the required frequency and amplitude. A suitable signal applied to the 50Ω input automatically overrides a signal applied to the 1 MΩ input.

1.6 OPTIONS.

1.7 All options should be ordered at the time of purchase.

1.8 FUSED H.F. INPUT.

1.9 The option 41 overdrive protection includes a commonly available easily replaceable 0.1 amp fuse, soldered between the input connector and the attenuator circuitry. The fuse protects the attenuator circuitry from input signals exceeding the 5 volt maximum (standard on 7580C).

1.10 8th DIGIT.

1.11 The option 08, 8th digit provides an extra full digit of resolution on the instrument display (standard on 7580C).

1.12 RECORDER.

1.13 The option 51 BCD output provides grounded electrical output of all Display indicators in 1-2-4-8 BCD coded logic form. The option also provides for the remote selecting of Hold and for remote read command.

1.14 TCXO.

1.15 The option 21 or 22 high stability reference oscillator replaces the internal crystal oscillator with a self contained temperature compensated crystal oscillator. This option offers significant improvements on the aging rate and temperature stability of the reference. (Option 21 standard on 7580C.)

1.16 RACK MOUNTING

1.17 The Model 7580 Counter may be rack mounted in either a 3-1/2 inch panel (Option 60) or a 5-1/4 inch panel (Option 62). The installation instructions for these options are presented in paragraph 2.10 of the Installation and Operation section of this manual. Adequate clearance must be provided on all sides of the instrument to allow heat to be dissipated. Be sure that the instrument position permits adequate air circulation and that nearby equipment does not discharge hot air directly on the instrument.

1.18 MECHANICAL DESCRIPTION.

1.19 The Model 7580 is completely self contained and enclosed in a die-cast, aluminum case. The case is in a unique "clam shell" configuration, providing full protection to both circuitry and controls for most field applications. The two case halves are held together by two cam action slide latches. This method securely holds the case together while permitting easy access to the circuitry.

1.20 The circuitry is arranged on three separate printed circuit boards. The largest of these, the counter board, occupies the bottom half of the clam shell case. The small display board plugs into the counter board directly behind the front panel. The power supply is mounted in the upper half of the case. On instruments equipped with the option 51 BCD output, this board is mounted beneath the counter board.

1.21 ELECTRICAL DESCRIPTION.

1.22 The circuitry of the Model 7580 is shown in block form in figure 1.1 and consists of signal conditioning circuits and steering logic, a counter and display circuit, and circuitry for generating a precise gate signal.

1.23 The input signal is amplitude adjusted (and divided by four in the F_C block) and reaches the steering logic as a square wave. From here the signal is routed through a gate to the counter.

1.24 The gate is controlled by a precise gate signal, the period of which is determined by the resolution selected on the instrument front panel. The signal is generated by a Timebase circuit which provides selectable sub-multiples of the reference oscillator.

1.25 The counter circuit counts the number of pulses from the steering logic for the gate period. The number of pulses counted are then read in the Display.

1.26 SPECIFICATIONS.

1.27 Specifications are shown in table 1.1.

1.28 MISCELLANEOUS.

1.29 Items Furnished.

1.30 The product manual and power cable are provided with each instrument.

1.31 Included with instruments equipped with the 51 option are a 50 pin edge connector, two mounting screws and two mounting nuts.

1.32 Required Tools and Test Equipment.

1.33 A list of equipment for performance check is provided in table 3.1 on page 3-1; for Calibration a 5 MHz reference source, as described in table 5.1 of page 5-1, is required. No tools are required for access to the internal circuitry. For more extensive disassembly, a #1 Phillips head screwdriver is used.

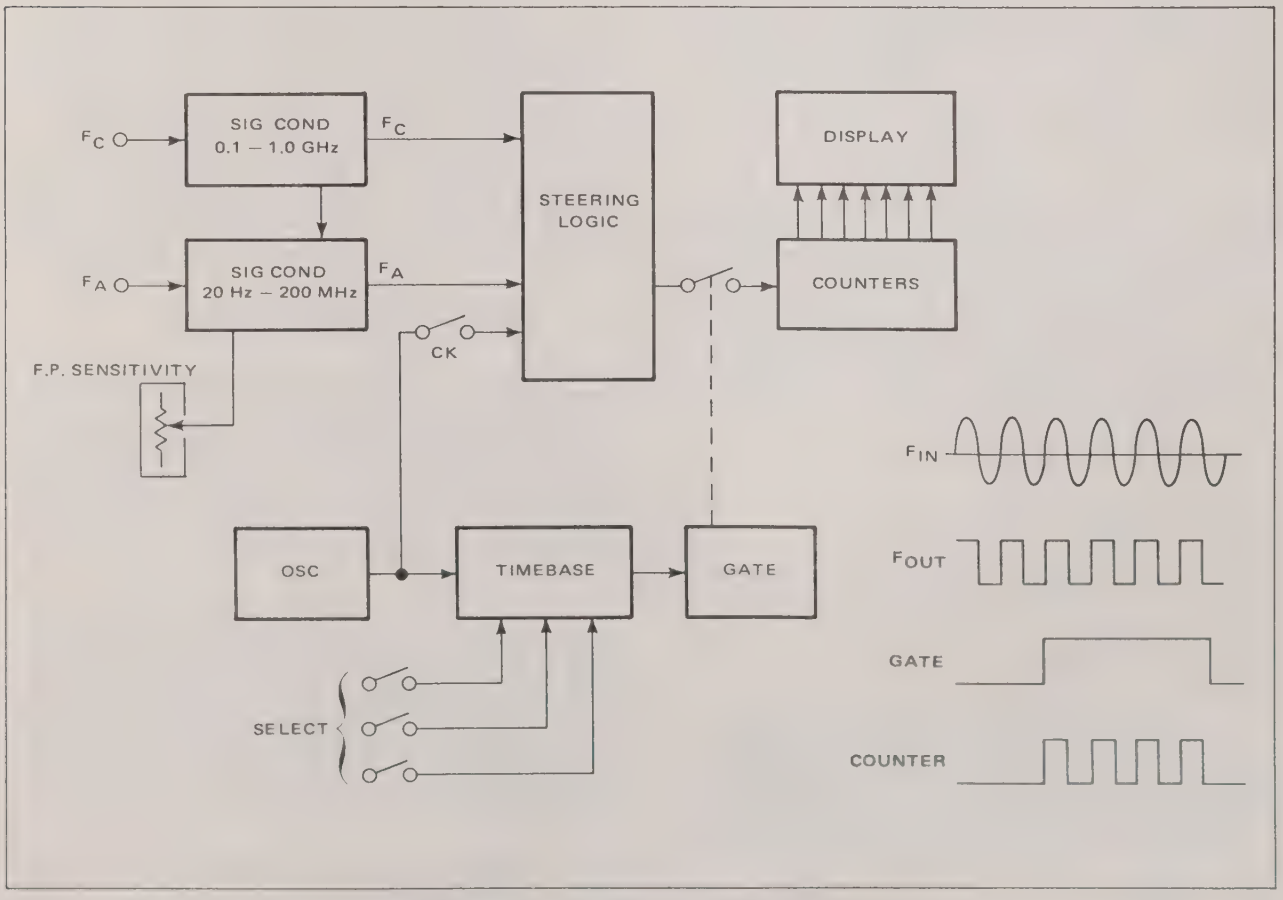


Figure 1.1 - Block Diagram - Model 7580

Table 1.1 - Specifications

MEASUREMENT SPECIFICATIONS	
Frequency Range:	
F_A Input	20 Hz to 200 MHz
F_C Input	100 MHz to 1 GHz
Accuracy:	±1 count ± reference error
Input Characteristics:	
F_A Input	
Sinewave	
Sensitivity:	50 mV RMS
Impedance:	1 Mohm shunted by 25 pF
Maximum Input:	250V RMS to 10 kHz, decreasing linearity to 5V RMS at 200 MHz
Voltage Range:	Continuously variable vernier control
F_C Input	
Sinewave	
Sensitivity:	10 mV RMS
Impedance:	50 Ohm nominal
Maximum Input: (operating)	1V RMS
Maximum Input: (without damage)	5V RMS
Sinewave	
Sensitivity: (with overdrive protection)	15 mV RMS
Measurement Time:	10m seconds to 10 seconds, selectable in decade steps. F_C Input prescaled by 4
Self Check:	1 MHz
Frequency Ratio Measurements:	
F_A Input:	20 Hz to 200 MHz (Nom.)
F_B Input:	1 kHz to 1 MHz (Denom.)
F_C Input:	100 MHz to 1 GHz (Nom.)
Ratio Range:	10^4 (Nom.) to 10^8 (Nom.) F_B F_B
Multiplier:	Numerator scaled by 10^4 to 10^8, selectable in decade steps
Accuracy:	±1 count Numerator ± trigger error of F_B
F_B Input:	Same as external reference
Trigger Error:	$\frac{.0075}{\text{slope (V/}\mu\text{S)}}$ μS

GENERAL SPECIFICATIONS	
Standard Internal Reference Oscillator:	
Aging Rate:	$\leq 1 \times 10^{-6}$ per month
Temperature Stability:	$\pm 2 \times 10^{-5}$, 0°C to 50°C
Voltage Stability:	$\pm 1 \times 10^{-7}$, ±10% line voltage change
Warm Up:	30 minutes
Internal Reference Oscillator (Option 21) (Standard on 7580C)	
Aging Rate:	$\leq 3 \times 10^{-7}$ per month
Temperature Stability:	$\pm 2.5 \times 10^{-6}$ 0°C to 50°C
Voltage Stability:	$\pm 1 \times 10^{-7}$, ±10% line voltage change
Warm Up:	30 minutes
Optional TCXO: (Option 22)	
Aging Rate:	$< 1 \times 10^{-7}$ per month (0.1 ppm)
Temperature Stability:	$\pm 5 \times 10^{-7}$ 0°C to 50°C (0.5 ppm)
Voltage Stability:	1×10^{-7}, ±10% line voltage change (0.1 ppm)
Warm Up:	30 minutes
Reference Output:	1 MHz square wave, buffered, TTL compatible
External Reference:	1 MHz, 1V RMS into 1 Kohm
Display:	LED; 7 digits standard,8 digits optional(8 digits standard on 7580C)
Reset:	Front panel Reset push-button or remote TTL command clears counter and initiates new reading
Hold:	Retains prior frequency reading until reset command initiates new reading
Input/Output Connectors:	BNC
BCD Output (Optional):	1-2-4-8 TTL of front panel readout, including decimal point and annunciator
Operating Temperature:	0°C to 50°C
Line Voltage:	100, 120, 220, 240V ±10% 48 Hz to 440 Hz
Power Requirements:	20 watts, maximum
Weight:	3.6 kg
Dimensions:	Half-rack

2.1 UNPACKING AND INSPECTION.

2.2 The Model 7580 Counter is packed in a molded plastic foam form within a cardboard carton for shipment. The plastic form holds the counter securely in the carton and absorbs any reasonable external shock normally encountered in transit. Prior to unpacking, examine the exterior of the shipping carton for any signs of damage. Carefully remove the counter from the carton and inspect the exterior of the instrument for any signs of damage. If damage is found, notify the carrier immediately.

2.3 BENCH OPERATION.

2.4 Each counter is equipped with a tilt bail or "kickstand" to enable the front of the instrument to be elevated for convenient bench use. The tilt bail is attached to the two front supporting "feet" at the bottom of the instrument. For use, the bail is pulled down to its supporting position.

2.5 Power Connections.

2.6 Power is supplied to the counter through a standard 6 foot long detachable power cord. The ground pin (round) on the power plug is electrically connected to the mainframe of the counter. It is important that this pin be connected to a good quality earth ground.

2.7 The cord connects to the power connector module located on the rear panel which incorporates a fuse holder and power line voltage level selector.

2.8 The fuse holder and power selector are accessible only when the power cable is removed. The power fuse is ejected by a lever marked FUSE PULL. The instrument uses a 1/2 amp fuse for 100 and 120 volt operation and a 1/4 amp fuse for 220 and 240 volt operation.

2.9 The instrument is made compatible with the available line voltage by the position of a small printed circuit board that fits into a slot in the module below the fuse. The board can be inserted into the slot in any one of four ways to provide for operation on the four available line voltage levels. The instrument is compatible with line frequencies from 48 to 440 Hz.

2.10 RACK MOUNTING OPTIONS.

2.11 The Model 7580 may be mounted in a standard 19-inch rack in a 3-1/2-inch vertical space using the Option 60 rack mounting kit or in a 5-1/4-inch vertical rack space using the Option 62 rack mounting kit. Option 60 requires a minimum of clearance top and bottom for proper tooling.

2.12 Option 60 rack mounting hardware is illustrated in Figure 2.1. To install the rack mount proceed as follows:

a. Remove the case from the counter.

b. Remove the feet and bail from the case.

c. Hold the rack mount against the side of the case as shown in Figure 2.1 and mark the location of the holes on the case.

d. Center-punch the hole locations marked in the step above.

e. Drill the holes in the case with a no. 31 size drill. (No. 31 drill = .120 Inches.)

f. Remove any debris or drill chips from the case.

g. Attach the rack mounts to the case using four 6-32 x 3/8 type F sheet metal screws for each mount.

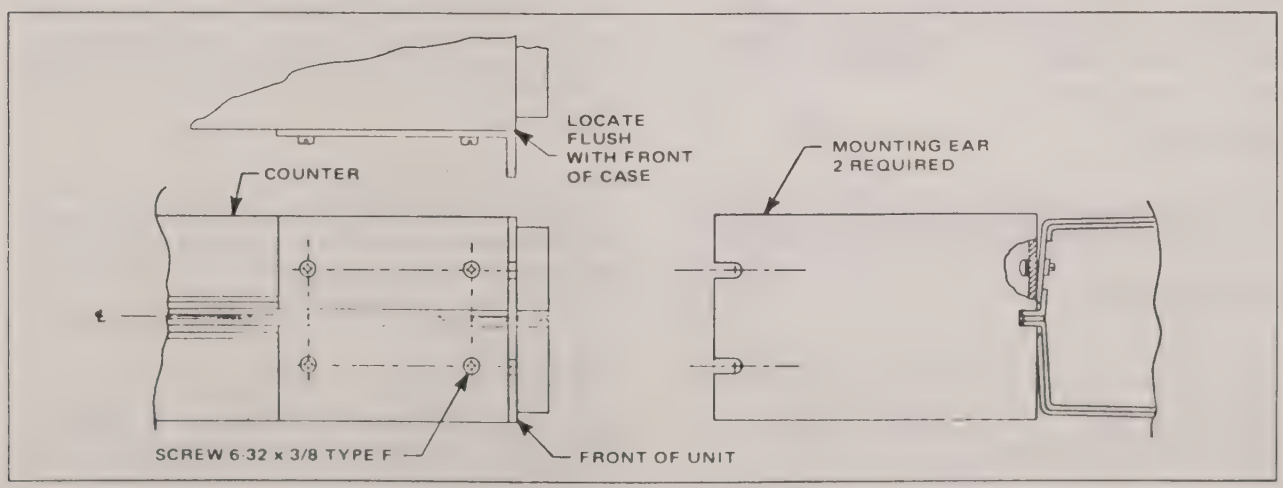


Figure 2.1 - Rack Mounting (Option 60)

h. Return the counter to the case.

i. Mount the unit in the rack.

2.13 Option 62 rack mounting hardware is illustrated in Figure 2.2. To install the counter in the 5-1/4 inch rack panel proceed as follows:

a. Remove the bottom feet and bail from the case.

b. Attach mounting bracket (730698) to the rack panel (730699) mounting studs with the hex nuts and lock washers.

c. Insert the counter in the panel assembly and clamp firmly against panel with clamps (730700). Tighten clamp retaining nuts.

d. Install the panel in the rack.

2.14 FRONT AND REAR PANELS.

2.15 The controls, inputs and outputs are illustrated in figure 2.3 and described in table 2.4.

2.16 OPERATION.

2.17 The remainder of this section deals with the use of the instrument and practical aspects of its various features. The instrument is designed for the simplest level of operation. After power is supplied and the frequency range selected, the applied input appears in the display.

2.18 DISPLAY.

2.19 The display is the term covering the red window dominating the upper left half of the instrument front panel. The display consists of a seven digit readout, an overrange indicator, and a gate indicator; instruments equipped with the 08 option have an eight digit readout. The readout indicates the numeric value of the counter and the completion of a measurement cycle. Nonsignificant zeroes are blanked to simplify reading.

2.20 Decimal.

2.21 The decimal position in the readout is determined by the resolution switch selected as shown in table 2.1.

2.22 Overrange.

2.23 The overrange indicator, a red "O" located at the lower left of the display, lights when the frequency of the input signal is greater than the instrument can display completely for the range selected.

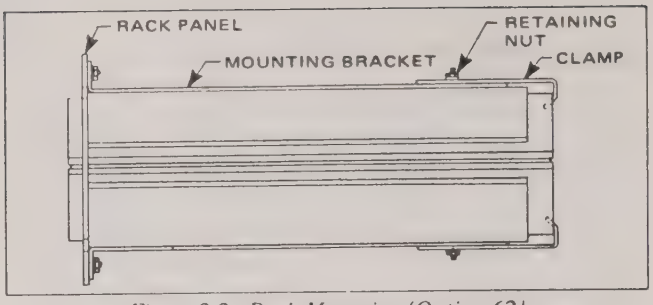


Figure 2.2 - Rack Mounting (Option 62)

Table 2.1 - Decimal Location

Range		Display
MHz	100 Hz	0* 0 0 0 . 0 0 0 0
	10 Hz	0* 0 0 . 0 0 0 0 0
kHz	1 Hz	0* 0 0 0 0 . 0 0 0
	0.1 Hz	0* 0 0 0 . 0 0 0 0

*08 Option Only (Standard on 7580C)

Table 2.2 - Gate Period

Range		Normal	F_C Selected
MHz	10 Hz	10 msec	40 msec
	10 Hz	100 msec	400 ms
kHz	1 Hz	1 second	4 seconds
	0.1 Hz	10 seconds	40 seconds

2.24 Gate.

2.25 The gate indicator, a red "G" located at the lower right of the display, lights during the measurement cycle and indicates the reading rate. The measurement period for both F_A and F_C inputs on the four ranges is indicated in table 2.2.

2.26 HOLD.

2.27 The HOLD switch is selected when a single reading is desired and/or a reading is required to be held indefinitely. It is normally used in conjunction with the RESET switch.

2.28 RESET.

2.29 The RESET switch is used only when the instrument is in the hold mode. When depressed, the switch generates a single measurement cycle. The number of measurements that can be taken in a given time period is determined by the gate period of the range selected (see table 2.2).

2.30 CHECK.

2.31 The CHECK switch allows the user to check the operation of the counter and timebase circuits. The

selection of CHECK overrides any F_A or F_C input, eliminating the need to remove the instrument from any test hookup. The application of an acceptable F_C input will however, modify the value of the reading.

Table 2.3 - Check Readings

Range		Normal	F_C Selected
MHz	100 Hz	1 . 0 0 0 0	4 . 0 0 0 0
	10 Hz	1 . 0 0 0 0 0	4 . 0 0 0 0 0
kHz	1 Hz	1 0 0 0 . 0 0 0	4 0 0 0 . 0 0 0
	0.1 Hz	1* 0 0 0 . 0 0 0 0	4* 0 0 0 . 0 0 0 0

*08 Option Only (Standard on 7580C)

2.32 The CHECK mode operates by feeding the internal reference oscillator output into the input of the counter circuits. In table 2.3 are shown the normal readings for CHECK for various conditions.

2.33 F_A.

2.34 This input is the left hand input connector on the lower right of the front panel. It is used in conjunction with the sensitivity adjustment control directly above it and provides a high impedance input for measuring frequencies from 20 Hz to 200 MHz. The input impedance can be further enhanced by using a standard ÷10 oscilloscope type probe, but with some accompanied loss in sensitivity.

2.35 F_C.

2.36 This input is the right hand input connector on the lower right of the front panel. It has an input impedance of approximately 50 ohms and internal circuitry that automatically controls the sensitivity. When a signal of the proper amplitude and frequency are applied to the input (indicated by the IN-RANGE lamp being lit), the signal overrides any signal that might be applied to the F_A input. The input measures signals from 100 MHz to 1 GHz at signal levels from 10 millivolts to 5 volts maximum.

2.37 RECORDER.

2.38 The recorder (option 51) converts the readout data into binary form for printers or other digitally operated equipment.

2.39 Mechanical Description.

2.40 All components for the option are on a single printed circuit board which is mounted below the instrument PCB on three spacers. A portion of the option board forms an edge-connector (J201) that extends through the rear panel. Data and power is routed between the two boards through connectors J2, J3, consisting of interlocking bi-forcated terminals located on both boards.

2.41 Electrical Description.

2.42 The data for digits 1, 2, and 3, the decimal points, and overrange are taken directly from circuitry on the counter printed circuit board. The data for the digits 4, 5, 6, 7, and 8, and the print pulse are generated on the option board.

2.43 The option, shown in block diagram form in figure 2.4, reconstructs the settings of the last 5 digits from the strobe and BCD outputs of the 5 digit counter chip. The circuitry also generates the print pulse to signify the data at connector J201 is ready to be recorded.

2.44 The timing sequence is illustrated in figure 2.5. Referring to this figure, the asynchronous transfer pulse ($\bar{c}$), generated on the counter board, is inverted by B4 on the option board and initiates the switched +5 volt supply to go on, providing power to the memory latches and the BCD and strobe reset gates. The $\bar{c}$ pulse also presets the two D flip flops of the print logic true and sets the latches false.

2.45 The rising edge of the A strobe sets print logic F/F A false. Strobes A through E sequentially load latches E5 through E1. The leading edge of the following A strobe sets print logic F/F A true which sets F/F B false. The negative going edge of F/F B generates a positive print pulse having a duration of slightly more than 6 μs. The negative edge of the print pulse sets the switched +5 volt supply off and the sequence is ended. The generation of the print pulse requires a minimum of 1.6 milliseconds up to about 2.5 milliseconds following the generation of the $\bar{c}$ pulse (the completion of the gate on the counter board).

2.46 $\overline{\text{HOLD}}$ (Remote).

2.47 The hold mode can be selected through the option by setting pin B4 of J201 to GROUND.

2.48 $\overline{\text{REMOTE RESET}}$.

2.49 The remote reset line serves the same purpose as the reset switch on the front panel. With the instrument in the hold mode, either by the front panel switch or remotely, a new reading can be generated by momentary contact of pin B3 to ground.

2.50 PRINT.

2.51 The print pulse signifies that the data at connector J201 (RECORDER) is available for printing. The pulse is positive going of approximately 6 microseconds or greater.

Table 2.4 - Front/Rear Panel Description

Reference Designator	Name	Description
(1) Power Switch	PWR	Green push-on/push-off switch. When selected, this switch supplies power to all portions of the instrument.
(2) Frequency	MHz - 100 Hz, 10 Hz kHz - 1 Hz, 0.1 Hz	4 black, mechanically interlocked, pushbutton switches. These switches select the resolution to which the input will be measured for either input (for internal or 1 MHz Ref only).
(3) Mode	CHK	Grey push-on/push-off. When selected this switch introduces a 1 MHz signal to counting circuitry for checking counter and time base operation.
	HOLD	Grey push-on/push-off. When selected, instrument retains the last measurement until HOLD is released or a RESET signal is introduced.
	RESET	Grey momentary contact. Used with HOLD (above). Initiates a single reading.
(4) BNC Connector	20 Hz – 200 MHz (F_A)	High impedance input used for frequency range indicated. Sensitivity is manually set.
(5) Potentiometer	Sensitivity	Provides continuous variable gain control permitting measurement of signals as low as 50 mV RMS.
(6) BNC Connector	.1 GHz to 1.0 GHz (F_C)	50Ω input impedance used for frequency range indicated. Sensitivity is automatically controlled permitting measurement of signals as low as 10 mV RMS. Measurable input to this connector overrides signal applied to (4).
(7) Indicator	IN-RANGE	Indicator lights when input signal applied to connector (6) conforms to frequency and amplitude requirements.
(8) LED's	READOUT	Displays measured frequency to 7 digits (8 with Option 08). Indicates decimal point location, gate, and overflow.
(9) Voltage Selecting and Fused Connector	POWER IN	This connector receives the female end of the power cable. Push in circuit card selects any one of four line voltages and indicates voltage selected (100, 110, 220, 240 volts). Unit also contains power fuse which must be removed to change line selector card. 1/4A is used for 100/110V operation; 1/8A for 220/240V operation.
(10) Reference Control Switch	INT-EXT	This is a two position slide switch. At the INT position the internal 1 MHz oscillator is used as the reference for all frequency measurements and a buffered TTL compatible square wave 1 MHz signal is available at connector (11). At EXT position the instrument is in a ratio mode and connector (11) will accept an external reference frequency of .75V RMS into 1 Kohm from 1 kHz to 1 MHz.

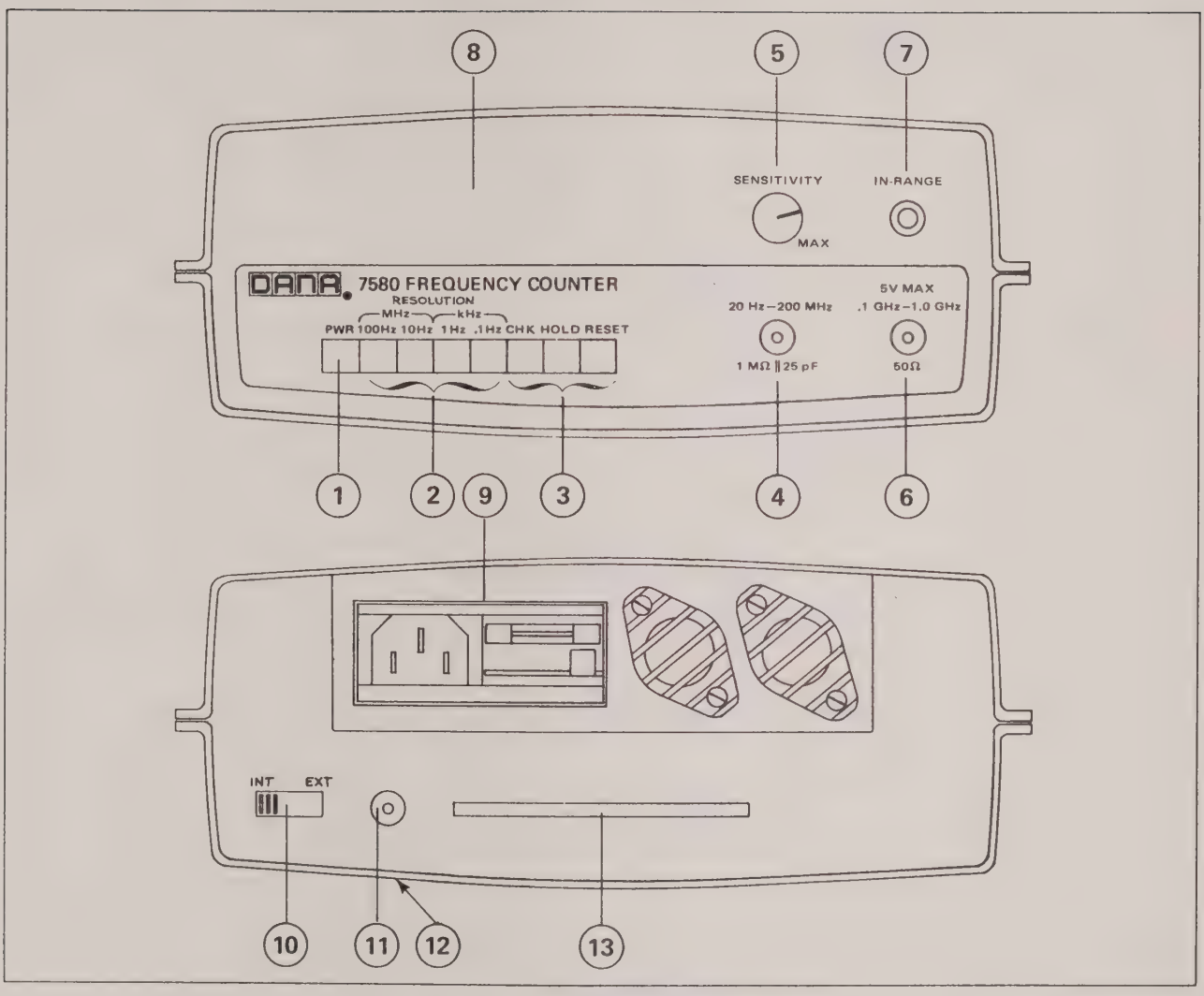


Figure 2.3 - 7580 Front/Rear Panel

Table 2.4 - Front/Rear Panel Description (continued)

Reference Designator	Name	Description
(11) BNC Connector	OSC (F_B)	Connector is used in conjunction with switch (10)
(12) Variable Capacitor	OSC ADJ	For fine adjustment of oscillator frequency. This control is located on the bottom of the instrument.
(13) BCD Output Connector	RECORDER	PCB edge connector is located in this position when instrument is equipped with Option 51 BCD output.

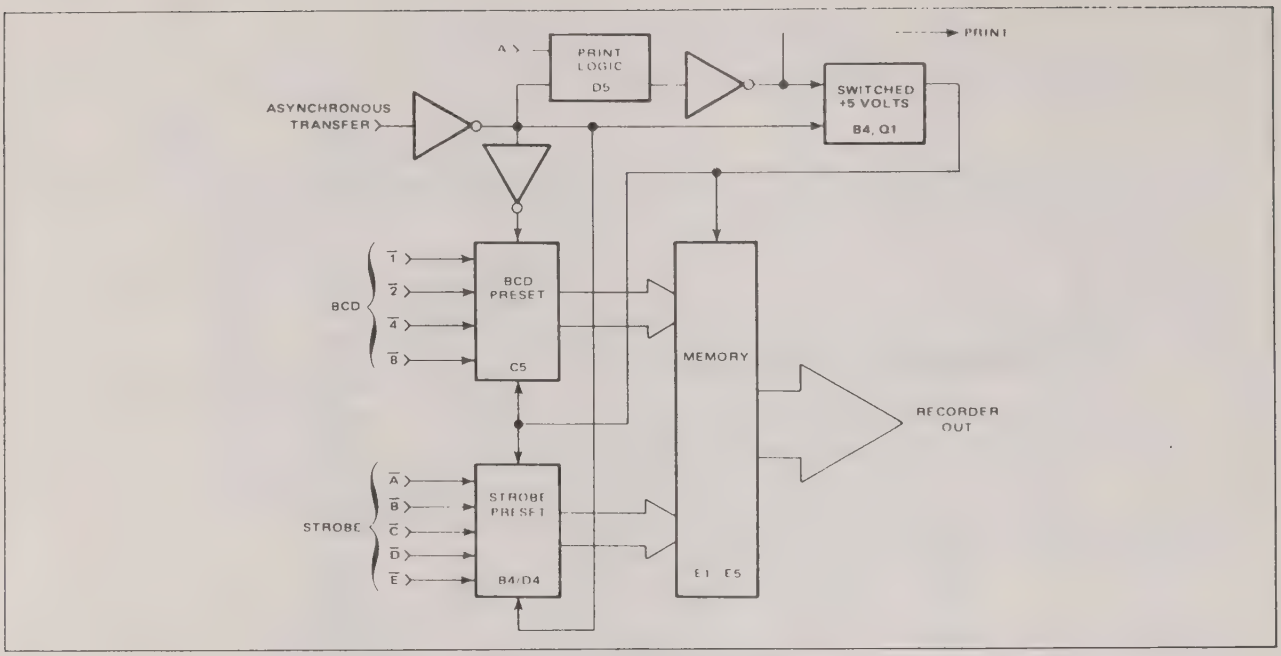


Figure 2.4 - Recorder, Block Diagram

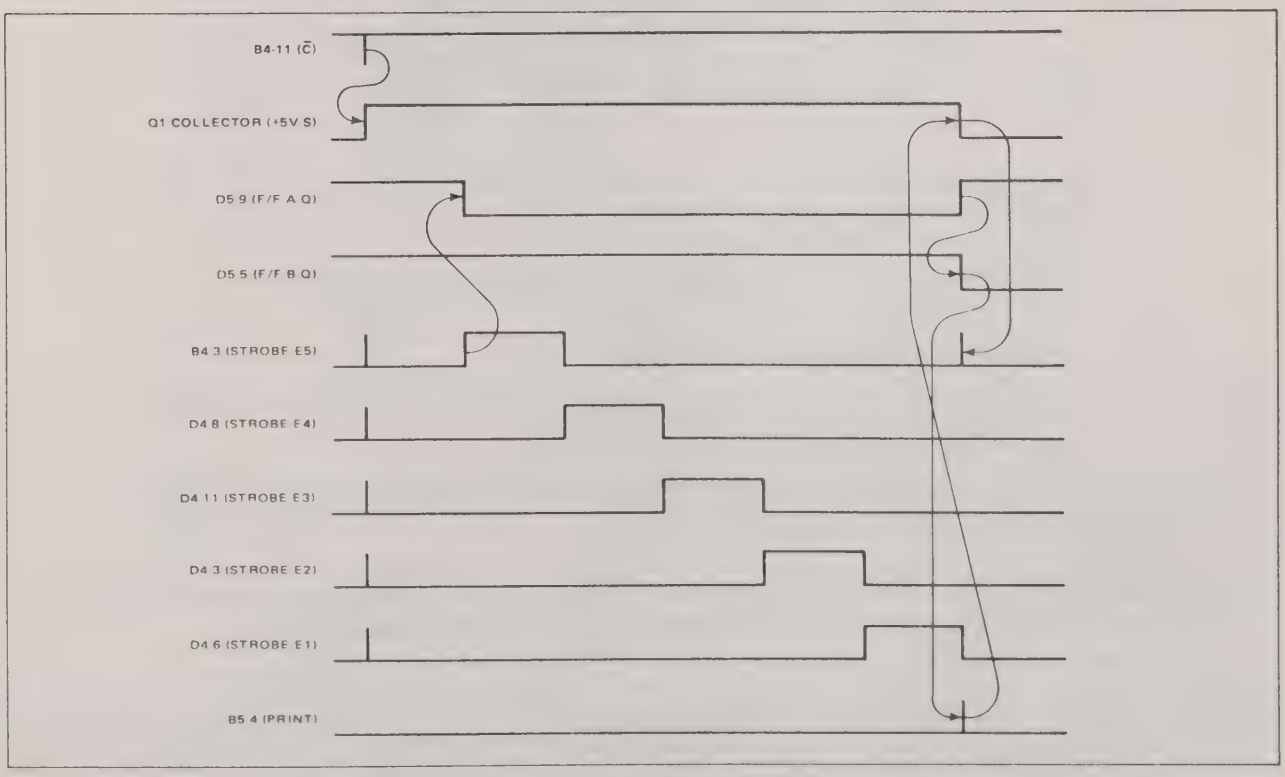


Figure 2.5 - Timing Diagram, Recorder

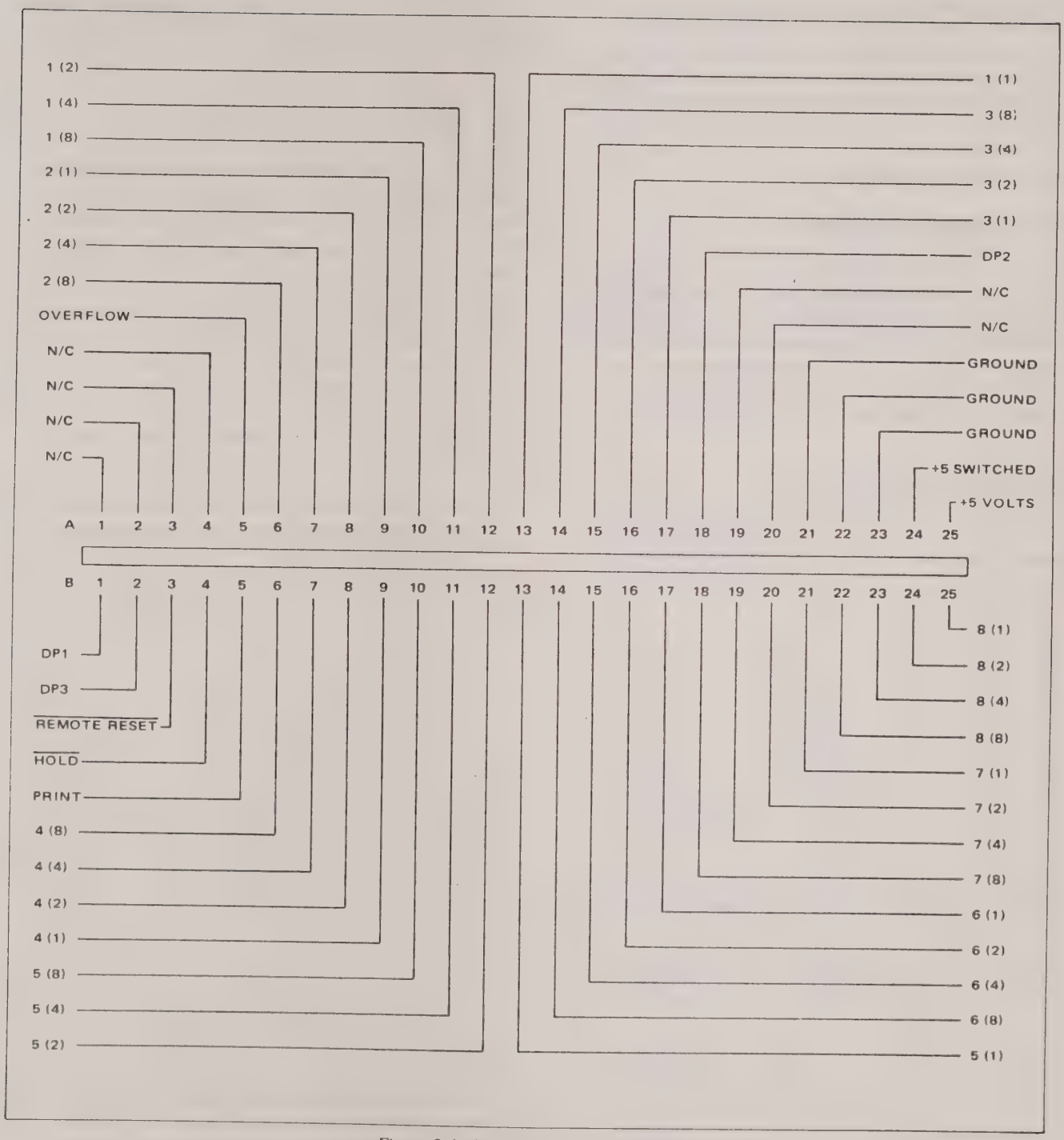


Figure 2.6 - Recorder Connector J201

2.52 INTERFACE.

2.53 Connector P201 (Dana P/N 600733) and two mounting screws are supplied with instruments equipped with the option. Pin locations are indicated in figure 2.5.

2.54 MISCELLANEOUS.

2.55 Grounding Requirements.

2.56 To protect equipment operators from possible injury in the event of shorts or fault currents, the front panel and case of this instrument are grounded in accordance with MIL-T-28800A. A low impedance ground is maintained through one conductor of the three conductor power cable supplied with the instrument, when the cable is plugged into an appropriate, properly wired, receptacle.

2.57 Storage Requirements.

2.58 The instrument can be stored at temperatures ranging from $-20^{o}C$ to $+70^{o}C$ at 75% relative humidity without adversely affecting operation or accuracy. The instrument must be brought to within the specified operating range (0^{o} to $+50^{o}C$) before power is applied.

2.59 Reshipment Packaging Requirements.

2.60 The shipping carton with its molded plastic foam form and plastic dust cover is specifically designed to provide the required support necessary for safe shipment. Whenever possible, these should also be used for reshipment.

2.61 If the original packing materials are not available, proceed as follows.

a. Wrap instrument in plastic or heavy paper.

b. Place packing material around all sides of instrument.

c. Place instrument and inner container in sturdy cardboard or wooden box. Mark box with appropriate cautionary labels.

SECTION 3 PERFORMANCE CHECK

3.1 INTRODUCTION.

3.2 This procedure is designed to ensure that the instrument is operating properly and within its published specifications. If any of the readings are not within tolerance, refer to the calibration procedure.

3.3 RECOMMENDED TEST EQUIPMENT.

3.4 Test equipment required for the performance checks is listed in table 3.1. Equipment having comparable specifications may be substituted for the individual items listed.

Table 3.1 - Required Equipment

Instrument Type	Required Specification	Recommended Equipment
Frequency Standard	5 MHz	—
Oscilloscope	1 MHz	TEK 454
VHF Signal Generator	50 - 220 MHz	HP8654A
UHF Signal Generator	60 - 1010 MHz	—
Alignment Tool	.075 Hex (Nonmetallic)	General Cement 9300
Alignment Tool	Blade (Nonmetallic)	—

3.5 PRELIMINARY PROCEDURE.

3.6 Check LINE VOLTAGE and select appropriate 115 – 230 volt switch position on rear panel and connect instrument to the power line. Set the power switch (PWR) to ON (IN) and provide 1/2 hour for temperature stabilization. Refer to the operation manuals of the test equipment to be used and provide appropriate warmup time.

3.7 Review the procedure and verify that all necessary equipment and hardware are assembled. Preset controls as given below.

INT-EXT Switch	INT
SENSITIVITY	MAX (Full clockwise)
PWR Switch	ON (IN)
CHK	ON (IN)
HOLD	OFF (OUT)

3.8 PROCEDURE.

3.9 In the following checks, select the indicated resolution, supply the input and verify the display is the same as the value shown.

3.10 Check Mode.

Resolution	Display	Overflow
100 Hz	1.0000	OFF
10 Hz	1.00000	OFF
1.0 Hz	1000.000	OFF
0.1 Hz	000.0000	ON
0.1 Hz	1000.0000*	OFF

*Option 08 Only (standard on 7580C)

3.11 With an oscilloscope, monitor output at OSC connector on rear panel for a 1 MHz T^2L compatible square wave. Remove scope.

3.12 Place INT-EXT switch to EXT. Note that gate light (G on front panel) stops gating on and off.

3.13 F_A Operation.

3.14 Make the following control changes.

INT/EXT switch	EXT
CHK	OUT

3.15 Apply an external reference of 1 MHz at 1V RMS locked to source. Select 1 Hz resolution. Supply the following frequencies at 50 mV RMS at the high impedance input (F_A).

Input Hz	Display	Overflow
1111111	1111.111	OFF
2222222	2222.222	OFF
3333333	3333.333	OFF
4444444	4444.444	OFF
5555555	5555.555	OFF
6666666	6666.666	OFF
7777777	7777.777	OFF
8888888	8888.888	OFF
9999999	9999.999	OFF
10000000	0000.000	ON
10000000	10000.000*	OFF

*Option 08 Only (standard on 7580C)

3.16 F_A Operation – Option 08.

3.17 This is a continuation of paragraph 3.13 and is for instruments equipped with option 08 (eight digit only).

Input (MHz)	Display	Overflow
10.XXXXXX	10XXX.XXX	OFF
20.XXXXXX	20XXX.XXX	OFF
30.XXXXXX	30XXX.XXX	OFF
40.XXXXXX	40XXX.XXX	OFF
50.XXXXXX	50XXX.XXX	OFF
60.XXXXXX	60XXX.XXX	OFF
70.XXXXXX	70XXX.XXX	OFF
80.XXXXXX	80XXX.XXX	OFF
90.XXXXXX	90XXX.XXX	OFF
100.XXXXXX	00XXX.XXX	ON

3.18 F_A Response.

Input	Amplitude (mV RMS)	Resolution	Display
10 Hz	50	1 Hz	0.010
20 Hz	35	1 Hz	0.020
50 MHz	35	10 Hz	50.00000
99 MHz	35	10 Hz	99.00000
200 MHz	35	100 Hz	200.0000
220 MHz	50	100 Hz	220.0000

3.19 Apply an input of 100 MHz at 1V RMS and set SENSITIVITY control fully counterclockwise. Verify counter stops counting.

3.20 F_C Response.

3.21 Apply the following frequencies to the 50 Ohms input (F_C).

Input (MHz)	Amplitude (mV RMS)	Resolution	Display
60	10	10 Hz	60.00000
100	8	100 Hz	100.0000
200	8	100 Hz	200.0000
300	8	100 Hz	300.0000
400	8	100 Hz	400.0000
500	8	100 Hz	500.0000
600	8	100 Hz	600.0000
700	8	100 Hz	700.0000
800	8	100 Hz	800.0000
900	8	100 Hz	900.0000
1000	8	100 Hz	*1000.0000
1010	10	100 Hz	*1010.0000

*Option 08 Only (standard on 7580C)

3.22 Repeat paragraph 3.18 using an input amplitude of 1V RMS.

3.23 Ratio Check.

3.24 Remove input to F_C. Attach 1 MHz to F_A at 50 mV and set SENSITIVITY control to MAX. Apply the inputs shown at the external reference connector and verify the values indicated in the table below.

Rear Input	Display	Overflow	Gate Time
500 kHz	2.0000±1 digit	OFF	20 ms
100 kHz	10.0000±2 digits	OFF	100 ms
10 kHz	100.0000±10 digits	OFF	1 sec
1 kHz	000.0000±86 digits	ON	10 sec
1 kHz	*1000.0000±86 digits	OFF	10 sec

*Option 08 Only (standard on 7580C)

3.25 Hold.

3.26 Remove signal to rear input. Set INT/EXT to INT. Select 1 Hz and HOLD. Momentarily depress RESET and observe that gate light energizes for one gate period only.

3.27 Internal Reference.

3.28 Apply a 5.000000 MHz house reference signal to F_A input. Verify a reading of 5000.000 ± .015 ($\pm 2 \times 10^{-6}$ OSC error).

SECTION 4 THEORY OF OPERATION

4.1 GENERAL.

4.2 This section covers the theory of operation of the Model 7580 counter. The operation of the unit is dependent on the mode selected. For this reason, general operating principles of each operation mode are described first followed by individual circuit descriptions.

4.3 Drawings provided in this section are included to aid in the description and are meant as a supplement to the complete set of drawings contained in Section 6.

4.4 MEASUREMENT MODES.

4.5 Figures 4.1 through 4.4 summarize the basic principles of each operating mode in simplified form.

4.6 Frequency A Mode.

4.7 During direct frequency measurements, the counter compares the unknown frequency against the known reference frequency (figure 4.1).

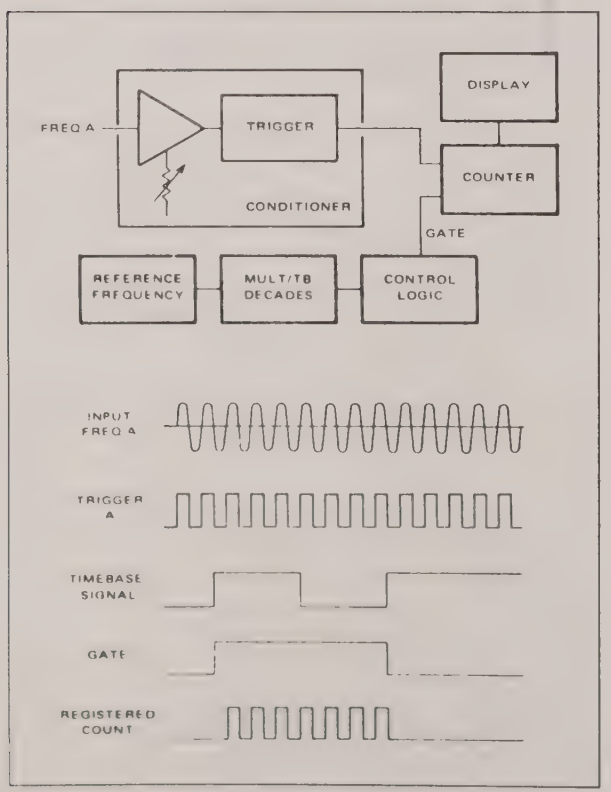


Figure 4.1 - Frequency "A" Mode

4.8 The input signal is adjusted manually for amplitude, processed into a square wave by the signal conditioning section, and routed to the counter. The internal reference supplies a 1 MHz signal to the timebase where it is divided and sent to the control logic which generates a "Gate" signal permitting input pulses to advance the counter.

4.9 The number of input pulses accumulated during the gate period is a measurement of the input frequency. The count obtained is displayed on the readout and is retained until the next measurement cycle is completed.

4.10 Frequency C Mode.

4.11 To select the frequency C mode, the unknown frequency is applied to the 50 ohm impedance connector (F_C). If the signal is of sufficient amplitude and within the 0.1 GHz to 1 GHz range, the frequency C mode is automatically selected; if a signal is applied to the frequency A input it is inhibited by the frequency C input (figure 4.2).

4.12 The frequency C input is fed to the prescaler, where the signal is automatically adjusted to the proper amplitude and frequency divided by four. The division is necessary to

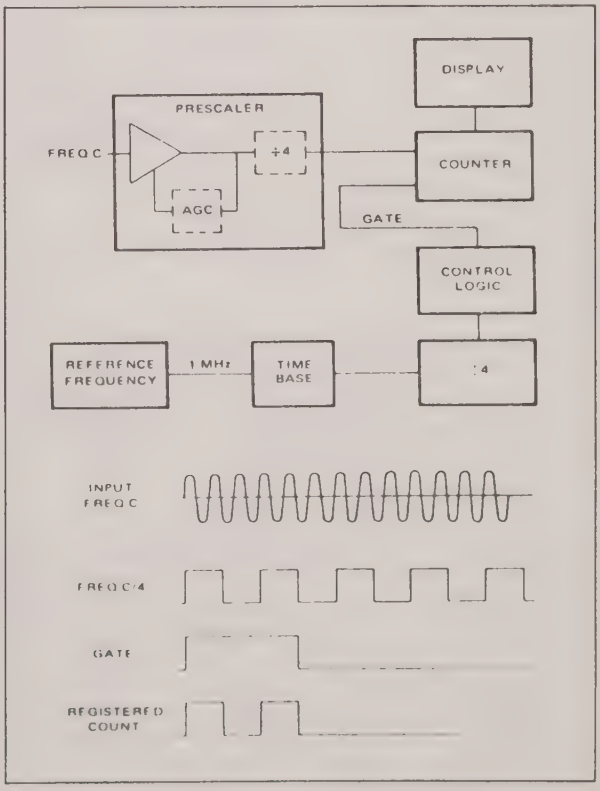


Figure 4.2 - Frequency "C" Mode

reduce the frequency to a rate that can be accepted by the counter. The output of the prescaler is routed to the counter.

4.13 The reference supplies a 1 MHz signal to the timebase where the signal is divided according to the range selected. The output of the T/B is divided by four to permit direct reading of the frequency C input. The remainder of the circuitry operates in the same manner as the F_A circuitry.

4.14 Ratio Mode.

4.15 This mode is identical in function to the frequency A and C measurement modes, but substitutes an external signal for the reference frequency. Signal flow in the Ratio mode with F_A input is shown in figure 4.3.

4.16 The two frequencies are compared by the relationship F_1/F_2, with F_1 being input F_A or F_C and F_2 being the external reference (signal applied to rear panel OSC input with INT/EXT switch in the EXT position).

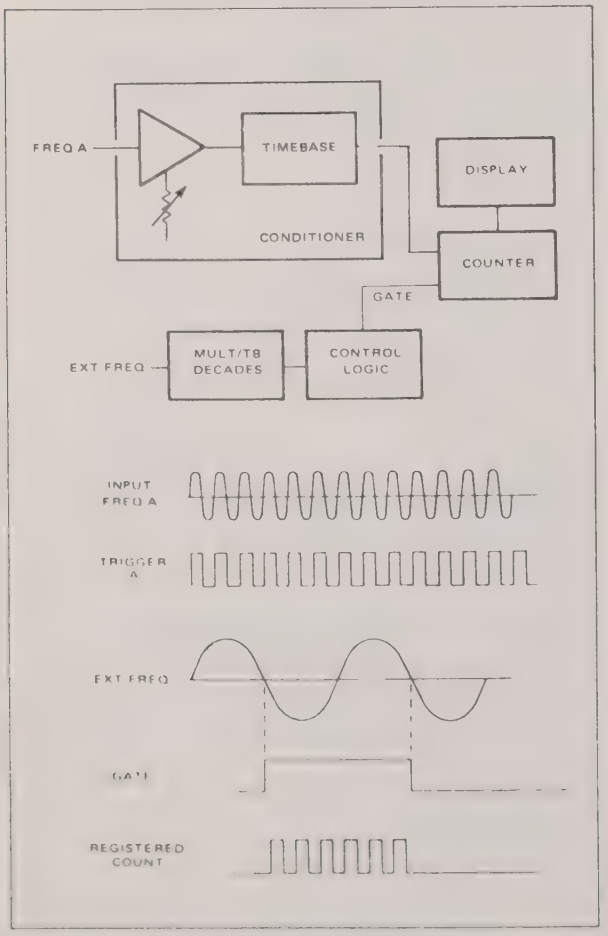


Figure 4.3 - Ratio Mode

4.17 Check Mode.

4.18 The check mode, figure 4.4, enables the user to verify that the instrument is operating correctly. In this mode, the reference is used to drive the T/B circuit as in frequency A and C modes and is also applied to the counter circuit. Proper operation is determined by selecting various ranges and observing the readout (see Section 3, paragraph 3.10).

4.19 CIRCUIT DESCRIPTIONS.

4.20 The block diagram of the counter is shown in figure 4.5. The timing relationship between various points in the control logic circuitry are provided in figure 4.18. The following paragraphs describe the operation of the major circuits of the instrument.

4.21 Signal Conditioning, F_A Input.

4.22 This circuitry provides manual control of the input signal amplitude and converts the signal to a square wave for the counting circuitry. The circuitry, shown simplified in figure 4.6, consists of a variable gain amplifier, a G_m converter and a balanced Schmitt trigger.

4.23 The variable amplifier consists of a dual gate FET (Q2). Gain of the stage is adjusted by varying the bias potential of the 2nd gate. The output of the gain stage

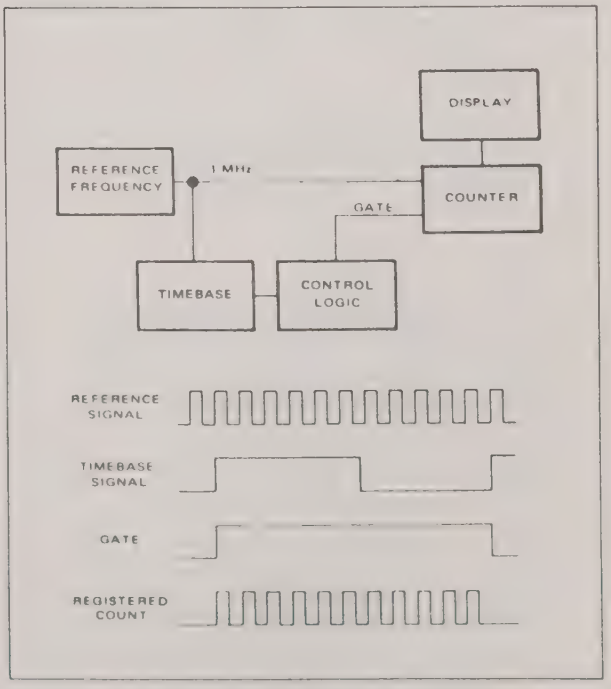


Figure 4.4 - Self-Check Mode

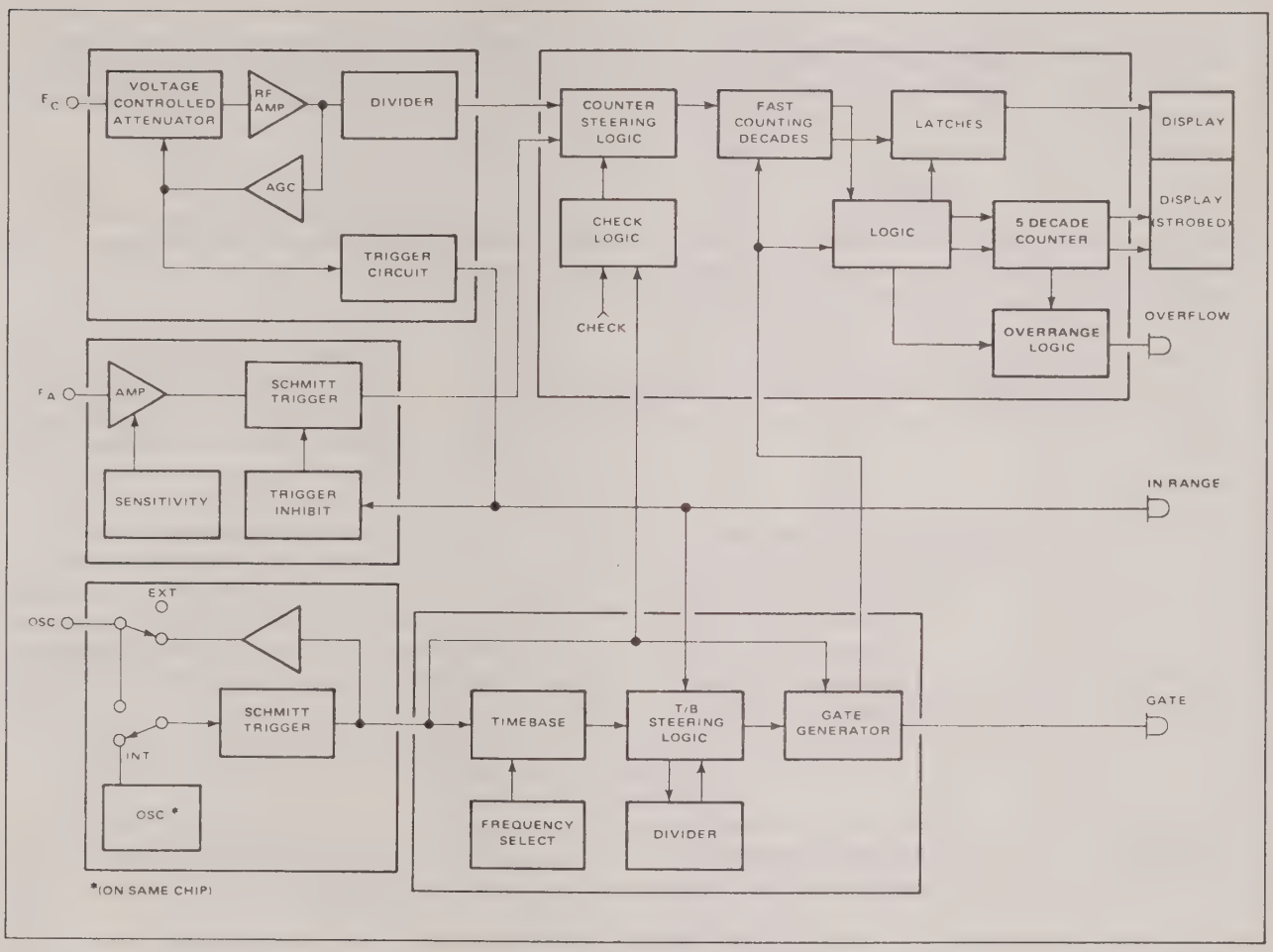


Figure 4.5 - Block Diagram

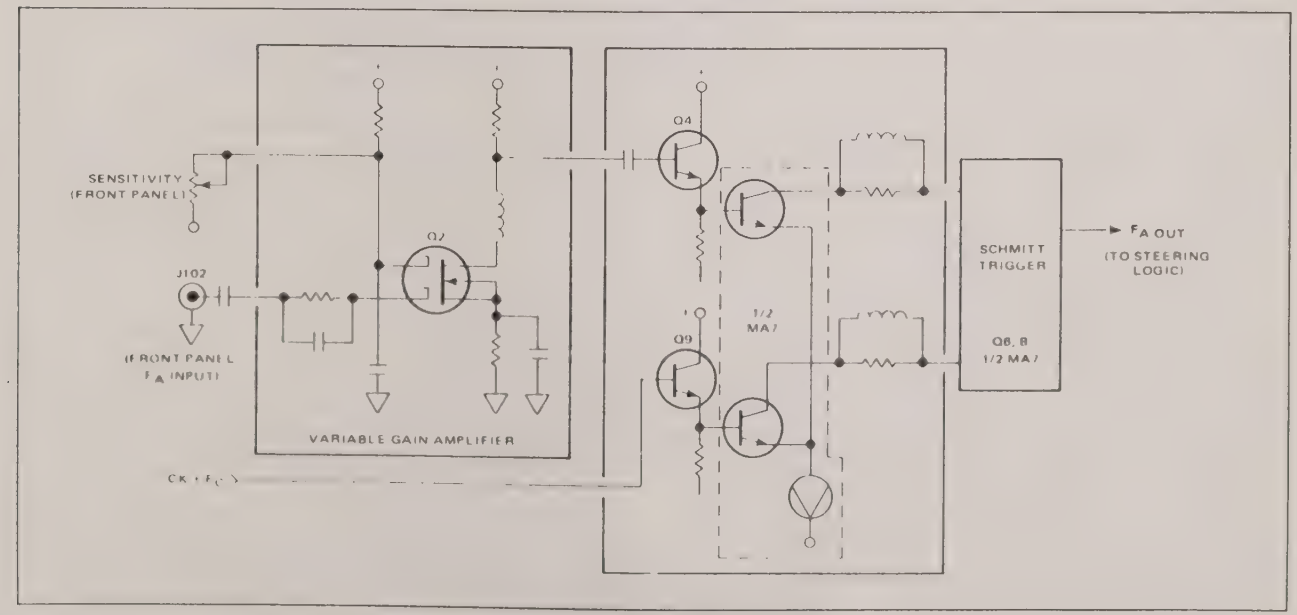


Figure 4.6 - Signal Conditioning, F_A

drives one input of a differential input G_m converter, consisting of a dual emitter follower input stage Q4, Q9 and a differential amplifier state (1/2 of MA7). The other input to this stage is logic signal CK + F_C. When this level is at logic false, the G_m stage provides additional gain to the F_A input signal for the Schmitt trigger; when the CK + F_C level is at logic true, the G_m stage is driven into an overload condition. This blocks the F_A signal and forces the trigger output false. The Schmitt trigger converts the F_A signal into a square wave and consists of transistors Q6, Q8, and a differential amplifier (1/2 of MA7). The output of the Schmitt trigger is applied to the steering logic. The squaring of the wave is required to insure noise immunity of the counters at lower frequencies.

4.24 Scaling, F_C.

4.25 This circuitry automatically adjusts the amplitude of the F_C input signal to provide a suitable level for the remaining circuitry, divides the input signal frequency by four, and generates a logic true, F_C signal when an input of the correct frequency range and of sufficient amplitude is applied to the F_C input connector. The circuitry, shown in figure 4.7, consists of an attenuator, amplifier, prescaler, automatic gain control, trigger circuit, and output signal gate.

4.26 The attenuator consists of two diodes in series with the input signal flow and three diodes shunting the signal flow. A variable bias voltage, applied in appropriate proportions and supplied by the automatic gain control (AGC), controls the amplitude of the signal that reaches the input of the amplifier.

4.27 The amplifier consists of two integrated amplifiers (A1, A2) operating in series and providing a voltage gain of approximately 100. The amplifier output drives the prescaler and the AGC circuitry.

4.28 The prescaler (MD9) is a high frequency digital counter capable of operating at the GHz range. The prescaler divides the frequency output of the amplifier by a factor of 4. The output is controlled by the output signal gate. Scaling is required to reduce the input frequency to a level compatible with the counter circuit.

4.29 The automatic gain control generates the operating bias for the input attenuator and provides the input for the trigger circuit. As shown in the figure the AGC feedback path consists of a rectifier CR18, CR19 and an operational amplifier MB9, Q26, Q27. The output of the amplifier is rectified and filtered to produce a proportional dc level. This dc level is amplified by the feedback amplifier circuitry to provide a control signal having a maximum excursion of from 0 to +10 volts.

4.30 The trigger circuit monitors the AGC output level and at a predetermined point, produces a logic true output.

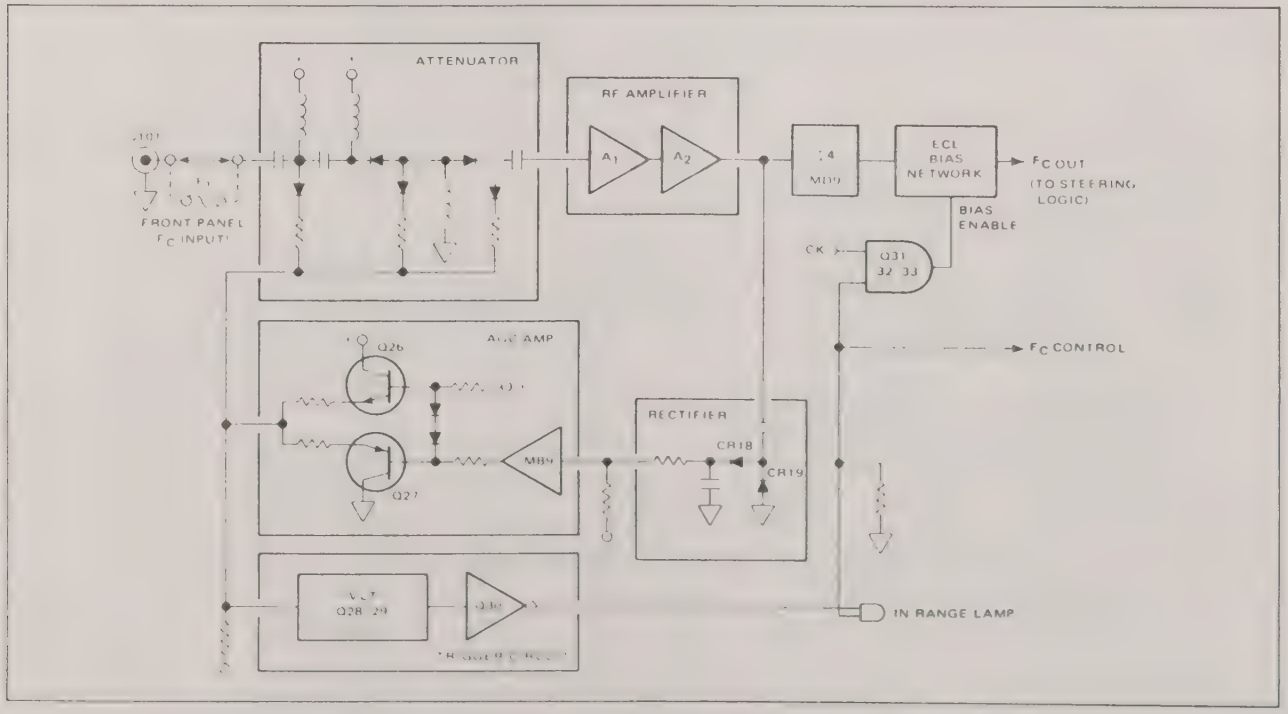


Figure 4.7 - Scaling Amplifier, F_C

The circuit is adjusted to produce a true output, when the input signal amplitude is sufficient to operate the counter circuitry. The circuitry is a voltage level trigger and inverter consisting of transistors Q28, Q29, and Q30. The output lights the front panel IN-RANGE light and generates logic F_C signal.

4.31 The output signal gate applies or removes the necessary operating bias for the ECL steering logic from the capacitor coupled prescaler output, thus effectively switching the F_C signal. The circuitry consists of Q32, Q33, and Q31, acting as an AND gate to control the bias.

4.32 Counter Steering Logic.

4.33 The steering logic controls which signal (F_A, F_C, or CK-FR) reaches the counters. The circuitry (figure 4.8) consists of two ECL OR gates and a T^2L inverter MF7.

4.34 Counter.

4.35 The counter, shown in figure 4.9, consists of five ECL F/F's, 2 T^2L decades, and a LSI MOS chip containing a 5 decade counter. These are combined using the advantages of each type of device to form an eight-decade counter. The counter input is selected by the counter steering logic and is controlled by the $\overline{GATE}$ from the control logic. The following paragraphs describe the operation of the unique sections of the counter.

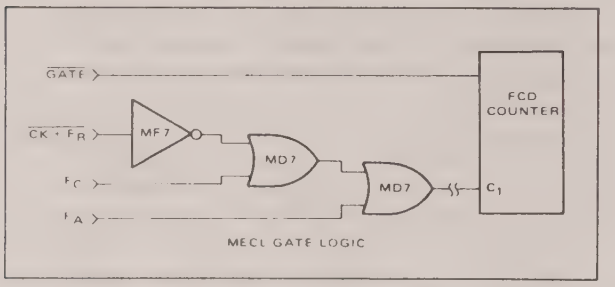


Figure 4.8 - Counter Steering Logic

4.36 FAST COUNTING DECADE.

4.37 This decade counts the highest frequency output of the F_C signal conditioning circuitry (250 MHz maximum) as well as the lowest possible specified input frequency (20 Hz from the F_A signal conditioning circuit). The fast counting decade consists of four ECL flip flops ME7, ME6, MD6 interconnected to divide the input by 10 in a 1-2-4-8 BCD format. The binary output of the decade is inverted, and buffered, and the required interface voltage shifts are provided by four PNP transistors (Q1, Q3, Q5, and Q7). The output of the inverters are fed to the input of the fast decade latch MC1. The frequency output of the fast counting decade is routed to the remaining counter circuitry.

4.38 3-DECADE COUNTER.

4.39 This circuitry divides the output of the fast counting decade by 100 and consists of a ECL flip flop driving the ÷5 portion of a T^2L decade counter (the ÷2 portion is not used) and a standard T^2L decade. The ECL flip flop MD6 is used to handle the output of the fast counting decade which can reach 25 MHz. The output of this device is inverted, buffered, and voltage level shifted by transistors Q10, Q26 to interface with the divide-by-five portion of MD1 and with latch MC2. This latch also stores the remaining binary data from MD1. The frequency output of MD1 (8 bit) drives the second T^2L decade divider (MD2) wired in conventional 1-2-4-8 format. The binary

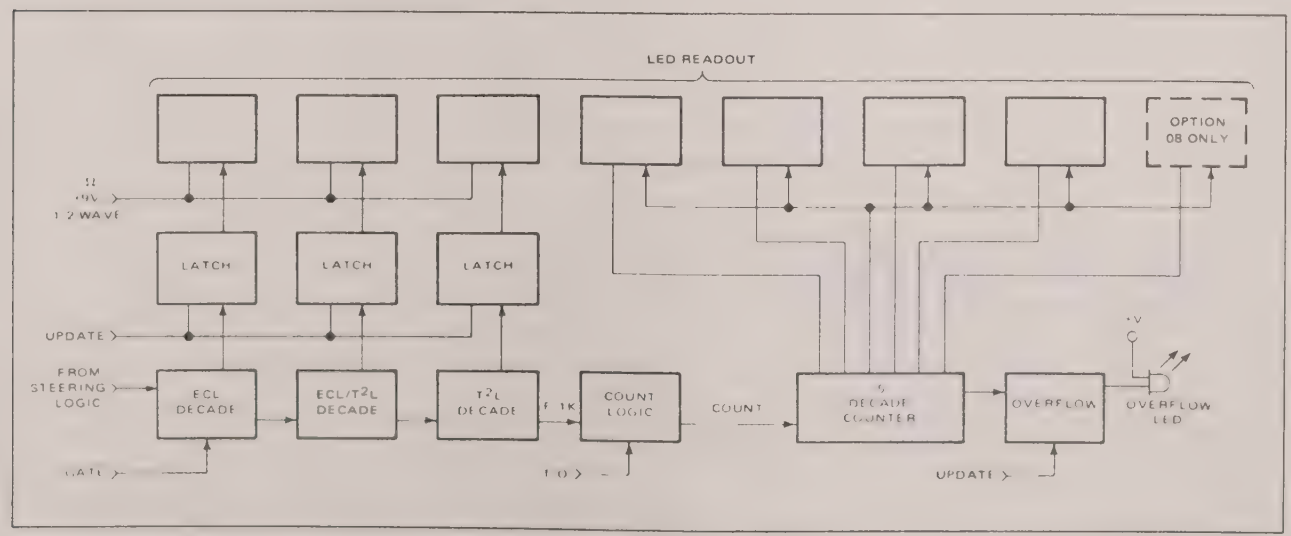


Figure 4.9 - Counter and Display

data from this chip is fed to latch MC3; the frequency output of this chip (8 bit) is designated F in ÷100 and fed to the counter logic circuitry.

4.40 DECADE COUNTER.

4.41 The five decade counter consists of a 5 decade BCD counter, five 4-bit latches, zero output detectors on each of the latches, a five step quad input multiplexer, a five stage counter, a blanking control, as well as sundry control logic, all contained on a single LSI chip. The output is on four BCD output lines, parallel fed to five LED readouts. The five LEDs are powered by one each of the five strobe lines from the LSI.

4.42 5 Decade LSI.

4.43 The five decade LSI is a single silicon MOS integrated circuit (MF4), shown in simplified form in figure 4.10. The circuitry counts and stores input pulses, and multiplexes the stored value for the display and recorder. The LSI also includes the circuitry for leading zero blanking and provides the control signal for the overflow indicator.

4.44 Referring to the figure, the counter is advanced by clock pulses applied to the C.P. input. The counter counts from 00000 to 99999 and overflows to 00000; the counter then continues counting. Overflow is indicated by a logic true at terminal count (TC). The counter is preset to zero by a logic false applied to the master reset (MR) input. The output of the counter consisting of 4 binary lines for each of the five counters drives the input of the latches. The latches transfer the data from the counter to the latches output upon receipt of a logic false transfer pulse (AT). This value is maintained at the latch output until another AT pulse is received. The multiplexing operation is performed by a five stage counter and the multiplexer. The five stage counter generates a separate strobe signal O_A through O_E each time the five stage counter is advanced. Each strobe signal allows a different set of BCD lines, O_1 O_2 O_4 O_8, from the latch to appear at the BCD output. Thus, when strobe line O_A is selected, the BCD output representing the first counter appears at the BCD output; when O_B is selected, the output of the second counter appears at the BCD output and so on. The stepping for the five stage counter is provided by external circuitry.

4.45 The strobe lines identify from which decade the BCD output is taken. The lines are gated however before they reach the external circuitry by the blanking control. The blanking control, with zero detect lines from the latches, permits the blanking of nonessential zeroes in the readout by inhibiting the strobe lines after a decimal signal (leading zero blanking) is received. The decimal signal is generated by external circuitry.

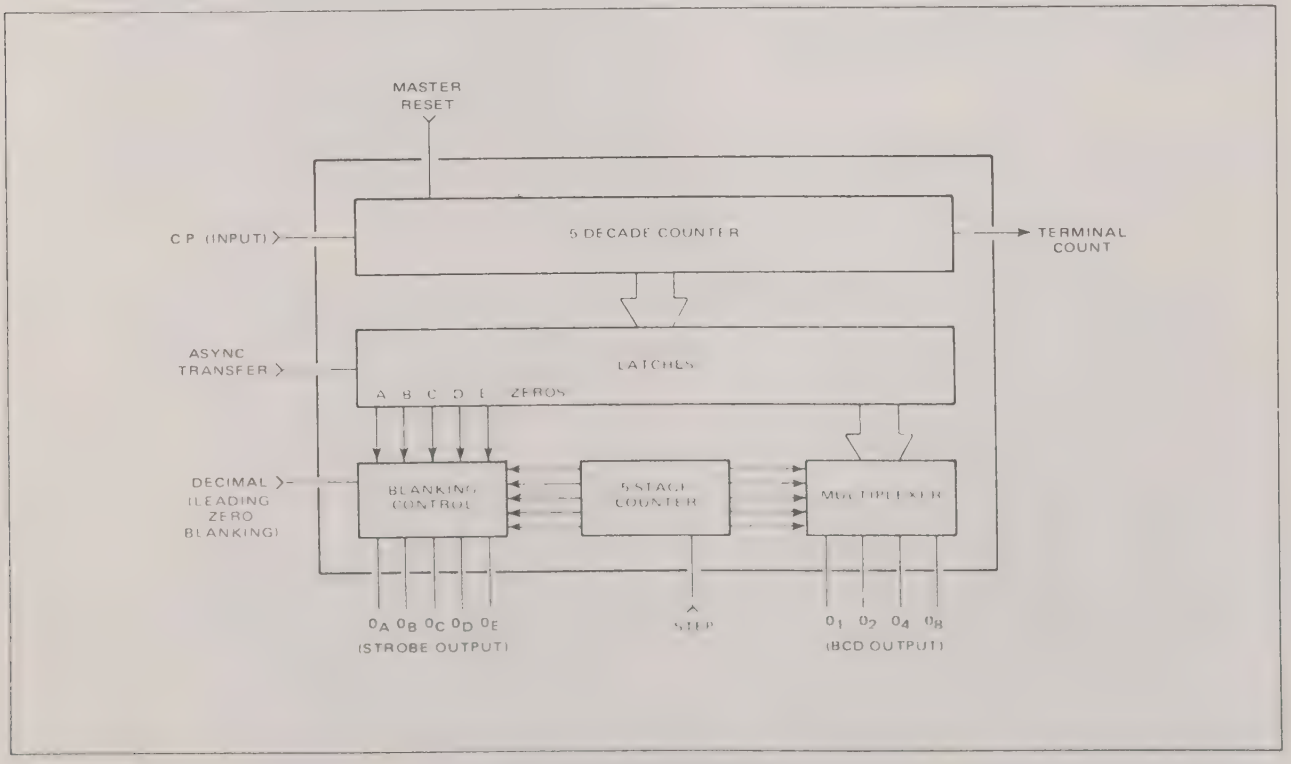


Figure 4.10 - 5 Decade LSI

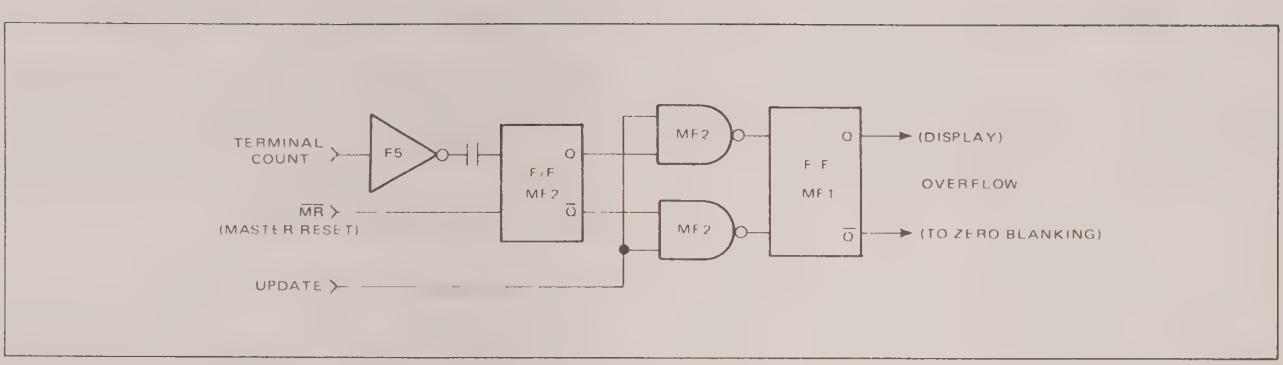


Figure 4.11 - Overflow Circuit

4.46 OVERFLOW CIRCUIT.

4.47 The overflow circuit, shown in figure 4.11, consists of an inverter, two R/S flip flops and two NAND gates. The circuit drives the overflow "O" lamp on the display and generates an inhibit signal to the zero blanking circuit to prevent the blanking of the displays during an overflow condition.

4.48 Referring to the figure, the normal state of f/f MF2 is Q false, $\overline{Q}$ true from the master reset. The update pulse transfers this output to f/f MF1, causing Q to be false (no overflow light) and $\overline{Q}$ to be true. If the five decade counter overflows, a terminal count signal is generated by the 5 decade LSI, which is inverted by F5 and drives f/f MF2 Q true. On the next update pulse, this is transferred to Q of MF1 causing it to go true and the "O" lamp lights. The following $\overline{MR}$ pulse resets MF2 Q false.

4.49 ZERO BLANKING.

4.50 The zero blanking circuit (figure 4.12) consists of four 3-input NAND gates. The circuit generates the control pulse for the leading zero blanking function of the five decade LSI. Blanking is controlled by the strobe input to DP on the 5 decade LSI; a false input inhibits any blanking. The strobe signal selected for each resolution overflow (DP false) is shown in table 4.1.

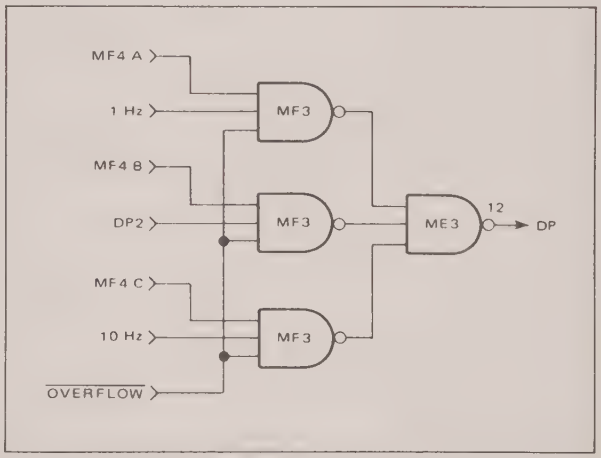


Figure 4.12 - Zero Blanking

Table 4.1 - Blanking Logic

Resolution Selected	DP Input	NO Input		Input	
		5-Decade Counter	Fast Count Decades	5-Decade Counter	Fast Count Decades
100 Hz	B	0 .0	0 0 0	0 .1	2 0 0
10 Hz	C	0 .0 0	0 0 0	0 .1 2	0 0 0
1 Hz	A	0	.0 0 0	1 2 0	.0 0 0
0.1 Hz	B	0 .0	0 0 0	1 2 0 .0	0 0 0
0.1 Hz	False	0* 0 0 0 .0	0 0 0	0* 0 1 2 .0	0 0 0
Strobe Lines		E D C B A		E D C B A	

*Option 08 Only (standard on 7580C)

4.51 STROBE OSCILLATOR.

4.52 The strobing oscillator consists of four inverters of hex inverter ME1. One inverter is used as a buffer for the output and three inverters are used to generate an approximate 3 kHz signal. The buffered output is used to drive the 5 stage strobe counter of the 5 decade LSI.

4.53 Timebase.

4.54 The timebase circuitry includes the external reference circuitry, the resolution select circuitry, and the timebase LSI.

4.55 TIMEBASE, LSI.

4.56 The timebase is contained on a single MOS integrated circuit (MF9), shown in simplified form in figure 4.13. The circuitry generates and divides the reference frequency. With BCD encoding, produced by external circuitry, the desired submultiple of the reference frequency is selected and routed to the output.

4.57 As shown in the figure, the oscillator generates the reference frequency with an external frequency determining circuit (feedback lines). The output of the oscillator is

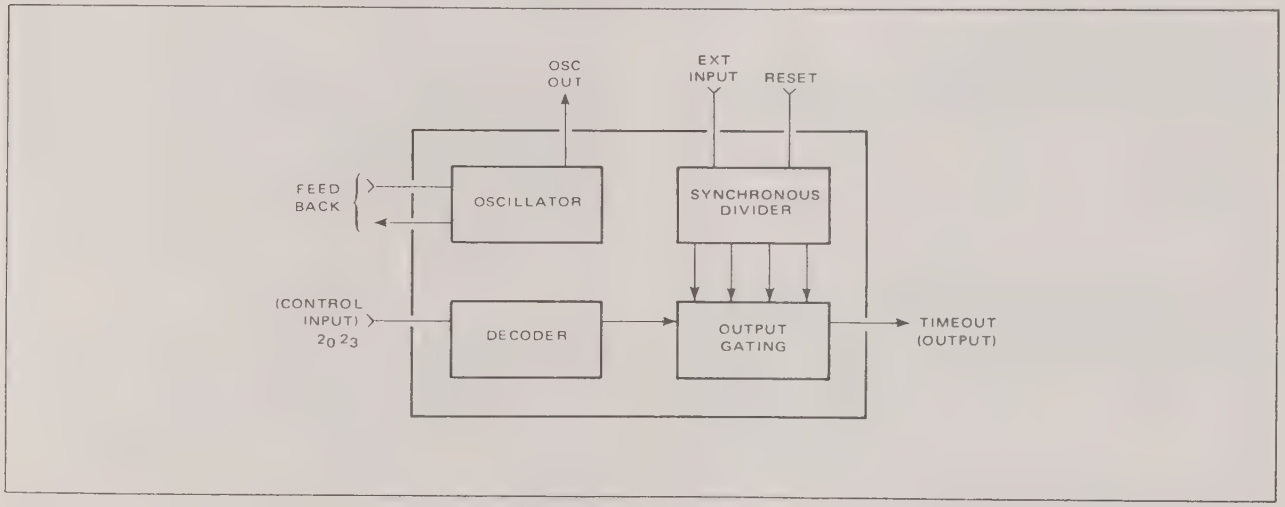


Figure 4.13 - Timebase

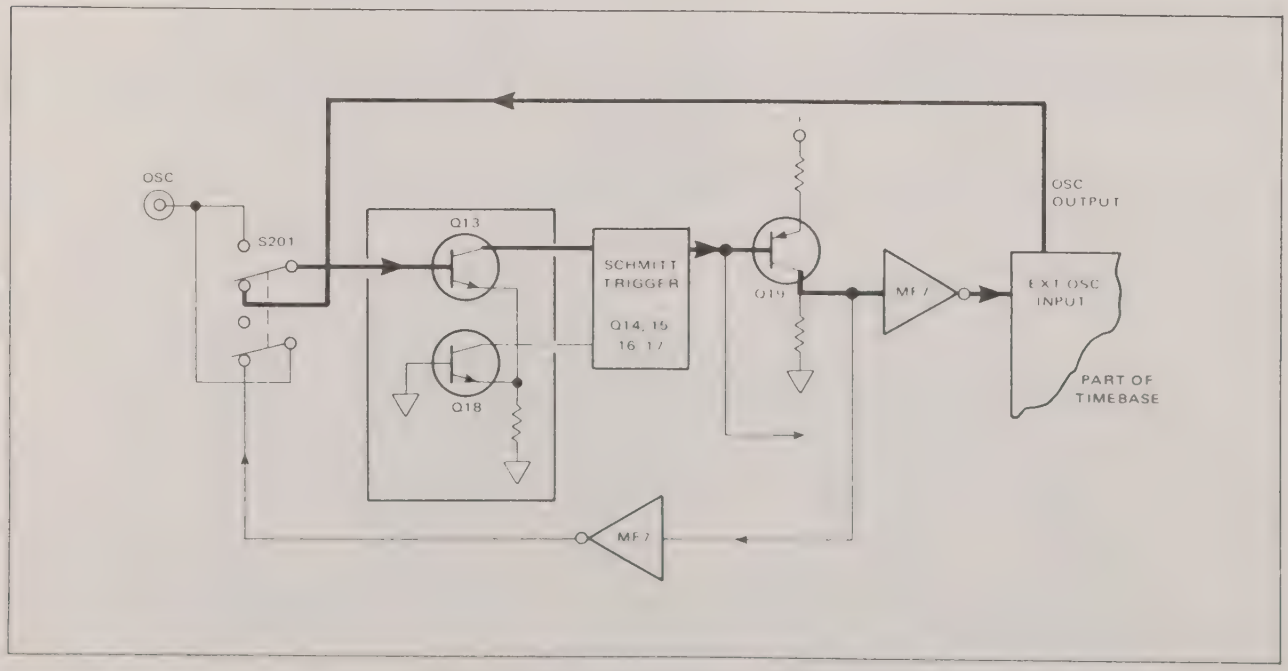


Figure 4.14 - External Reference Circuitry

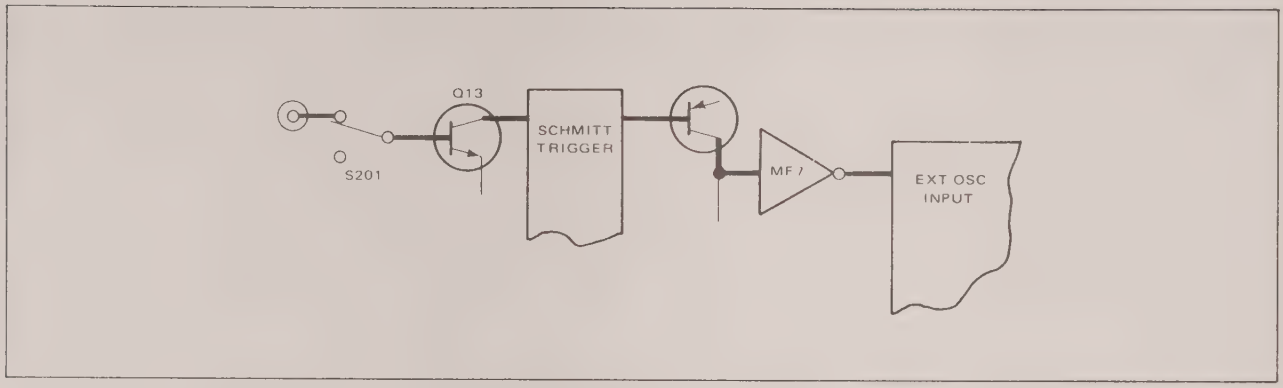


Figure 4.15 - Signal Flow, Ext. Ref. Selected

routed to external circuitry for conditioning before it is returned from the reference signal (external reference) to the synchronous divider. The divider produces 13 different outputs simultaneously which are fed to the output gating circuit. The output gating circuit using data from the decoder selects one frequency as the timeout signal. The decoder converts BCD inputs from external circuitry into data for controlling the output gating circuit.

4.58 EXTERNAL REFERENCE CIRCUIT.

4.59 This circuitry consists of a Schmitt trigger, three inverters and a double pole, double throw switch. The circuit operates in conjunction with the oscillator of the timebase LSI chip to provide internal reference or allow for external reference accepting frequencies from 1 kHz to 1 MHz (figure 4.14).

4.60 Figure 4.15 illustrates the signal flow when external reference is selected (S201 is in the EXT position). As shown, the external reference signal is routed through S201 to the input of the Schmitt trigger, where the input signal is converted into a square wave. The output of the Schmitt trigger is double inverted by Q19 and MF7 and fed into the external input (pin) of MF9.

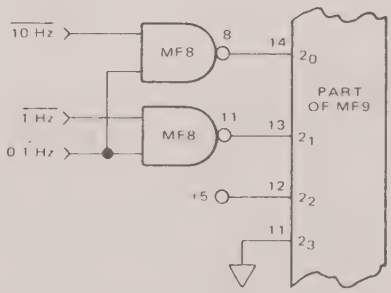
4.61 When internal reference (INT) is selected, the oscillator out signal, generated by the oscillator portions of MF9, is routed through S201 to the input of the Schmitt trigger, through the two inverters and to pin 3 of MF9. The output of inverter Q19 is also inverted by MF7-F and routed to J201. This provides the user with a reference synchronous 1 MHz frequency.

4.62 RESOLUTION SELECT.

4.63 The resolution select consists of two NAND gates (MF8). The two gates convert the position of the resolution switches into a BCD for selecting the desired timebase LSI output. The circuitry and code generated is shown in figure 4.16.

4.64 Control Logic.

4.65 The Control Logic, shown in figure 4.17, converts the timebase output to a Gate signal, controls the operation of the 5 decade counter chip, and generates various control signals for use throughout the instrument. The timing of the logic is shown in figure 4.18. In the paragraphs that follow the purpose and basic operation of each block is discussed.



RESOLUTION SELECTION	MF9 INPUT				MF9 OUTPUT (PERIOD)
	2_0	2_1	2_2	2_3	
100 Hz	0	0	1	0	10 MS
10 Hz	1	0	1	0	100 MS
1 Hz	0	1	1	0	1 SEC
0.1 Hz	1	1	1	0	10 SEC

Figure 4.16 - Resolution Select

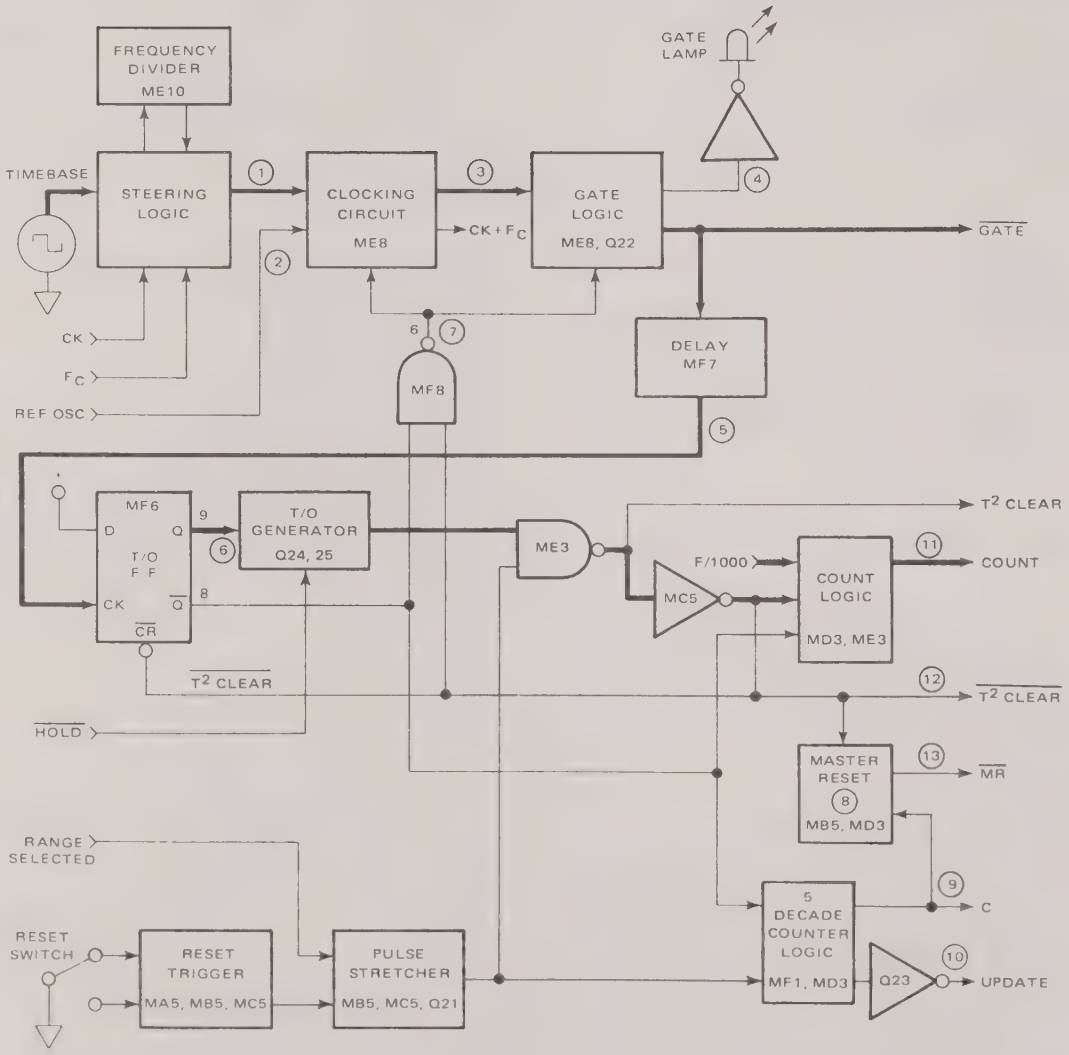


Figure 4.17 - Control Logic

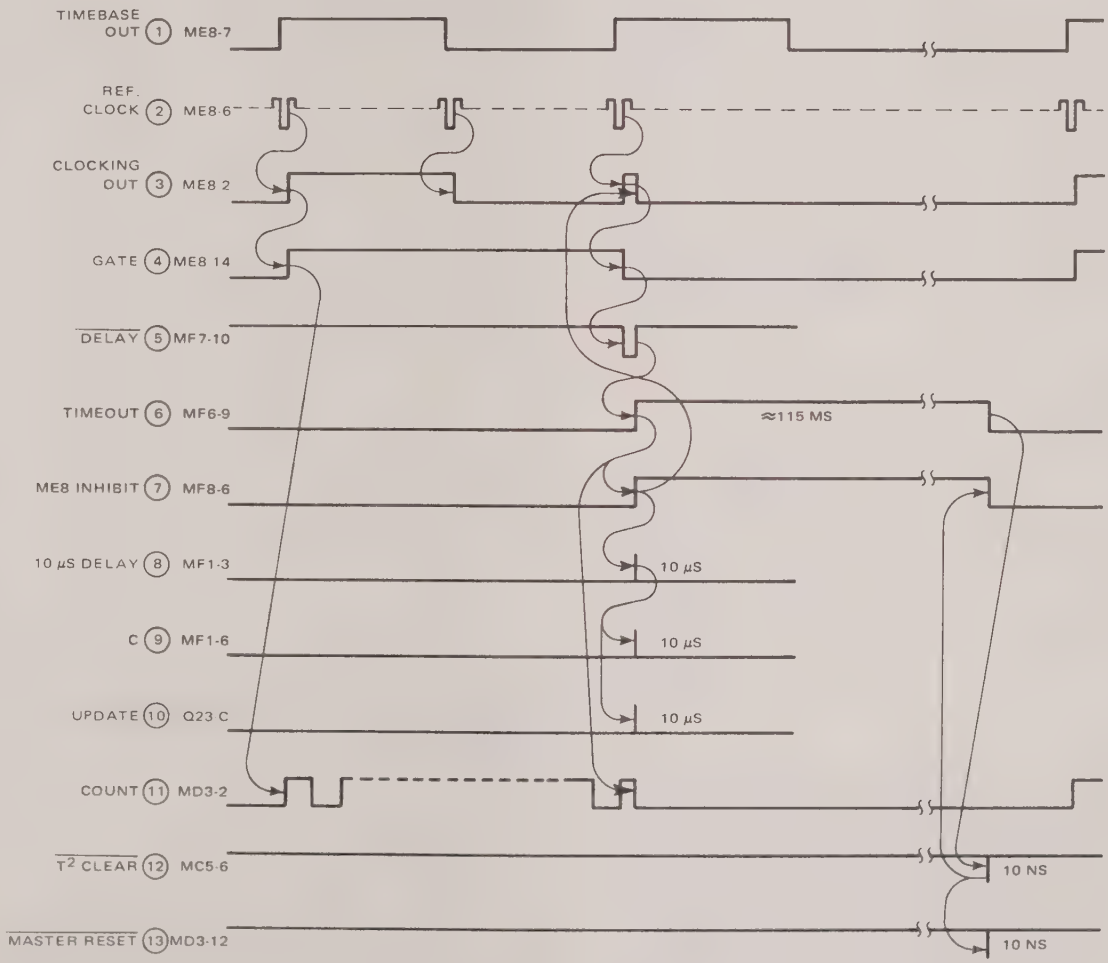


Figure 4.18 - Timing Diagram

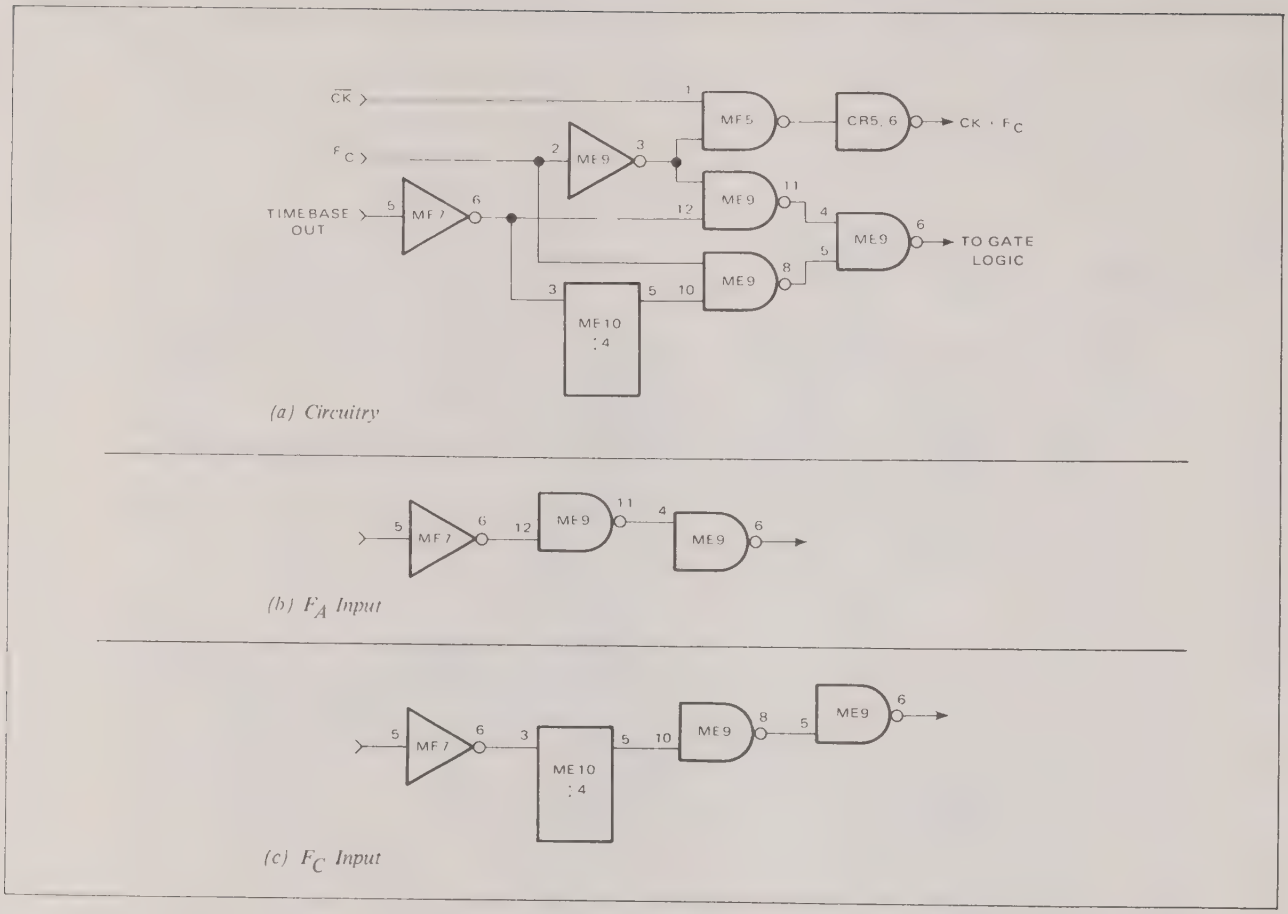


Figure 4.19 - Steering Logic

4.66 STEERING LOGIC.

4.67 The steering logic feeds the output of the timebase chip to the clocking circuit either directly or divided by 4, according to the mode of operation. It also generates the CK + F_C Control Signal. The circuitry used in the steering logic is shown in figure 4.19(a). With no measurement signal applied or with an input signal to the F_A input, the timebase output is routed through the circuitry as shown in figure 4.19(b). With an input signal to the F_C input (with or without CHECK selected) the output of the timebase is routed as shown in figure 4.19(c). With CHECK selected or with a signal input at F_C, the CK + F_C line is at logic true.

4.68 CLOCKING CIRCUIT.

4.69 The clocking circuit synchronizes the timebase output signal with the positive going edge of the reference oscillators. The circuitry consists of one half of a dual D type ECL flip flop ME8 with the D input supplied by the Steering Logic and the clock input from the reference oscillator conditioning circuitry. The flip flop is reset false and held false by the inhibit line.

4.70 GATE LOGIC.

4.71 The gate logic divides the output of the clocking circuit by two to produce a single gate pulse. It also generates the control signal for enabling the counter and operates the gate lamp drive circuit. The circuitry consists of the remaining half of the ME8 D flip flop, wired in a divide-by-two configuration. The flip flop is prevented from changing states after the completion of the gate pulse by the inhibit signal on the flip flop reset line.

4.72 DELAY.

4.73 The delay circuit generates a 10 microsecond pulse at the completion of the gate pulse. This is generated to permit the counter to settle before the series of control signals involving data transfer and the resetting of the counter

begins. The delay consists of two sections of the hex inverter MF7. Interface between the T^2L delay and the ECL gate logic is provided by Q22.

4.74 TIMEOUT FLIP FLOP.

4.75 The timeout flip flop enables the timeout generator, sets the count output false and inhibits the gate logic during the timeout period, and initiates the update and $\overline{MR}$ signals. The flip flop is clocked at the completion of the delay and reset at the completion of the timeout period by $\overline{T^2 CLEAR}$.

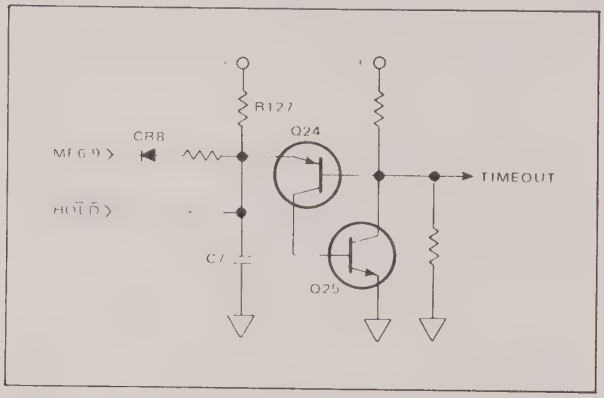


Figure 4.20 - Timeout Generator

4.76 TIMEOUT GENERATOR.

4.77 The timeout generator, shown in figure 4.20, produces a negative pulse approximately 100 milliseconds after the T/O F/F goes true. The timeout generator with the gate period determines the total period of the measurement cycle.

4.78 The output of the generator is fed through a NAND gate ME3 to become T^2 CLEAR and inverted again by inverter MC5 ($\overline{T^2 CLEAR}$).

4.79 COUNT LOGIC.

4.80 The count logic routes the output from the ECL and T^2L counters (f/1000) to the input of the 5 decade counter chip and fulfills a requirement of the chip by holding the input false after the count is complete.

4.81 MASTER RESET.

4.82 The master reset is a passive pulse generator, receiving its main command from the C line. The $\overline{MR}$ signal generated by this logic is used to reset the counters of the 5 digit chip and the overrange circuit.

4.83 5 DECADE COUNTER LOGIC.

4.84 This circuitry commands the three discrete latches and the overrange circuit to transfer data (UPDATE) and the five integral latches of the chip to transfer data (C). It also initiates the master reset logic.

4.85 RESET TRIGGER.

4.86 The reset trigger acts on electronic buffer to insure that only one reset pulse is generated by the reset switch. The output of the circuit drives a pulse stretcher circuit.

4.87 PULSE STRETCHER.

4.88 The pulse stretcher receives the input from the reset switch and insures that the pulse is at least 1 microsecond long. The output of the circuit is applied to NAND gate ME3 and the 5 decade counter logic to initiate a new read cycle.

4.89 Power Supply.

4.90 The power supply is mounted on a single printed circuit board mounted on one half of the instrument case. The supply can be operated from either 100, 120, 220 or 240V, 50 to 400 Hz. Voltage selection is made by a voltage-selecting, fused connector on the rear panel. The supply provides voltage level outputs of −12 volts, +12 volts, +5.2 volts, and +5 volts.

4.91 The circuitry, shown in figure 6.11, consists of a filtered full wave 8 volt supply driving two 5 volt 3-terminal integrated regulators U1 and U2 and a filtered full wave ± 17 volt supply driving two 12 volt 3-terminal integrated regulators U3 and U4. Regulator U1 provides a fixed voltage output of +5 volts; regulator U2 is adjustable by potentiometer R2 and operates at a +5.2 volt level. The output of U3 is fixed at +12 volts and the output of U4 is fixed at −12 volts. Diodes CR7, CR8, and CR9 provide transient protection for the regulators.

4.92 TCXO.

4.93 The option 21 or 22 temperature compensated crystal oscillator (TCXO) circuitry consists of a highly stable 10 MHz oscillator driving a ÷10 circuit. The divider reduces the oscillator output to 1 MHz for use by the reference circuitry.

SECTION 5 CALIBRATION

5.1 INTRODUCTION & DESCRIPTION.

5.2 This procedure covers the calibration of the Dana Model 7580 electronic counter and consists of adjustments to the reference frequency oscillator, the ECL power supply, the channel A sensitivity, and the channel C trigger.

5.3 The location of the reference oscillator adjustment depends on whether the instrument is equipped with the non-temperature compensated oscillator (Y1) or the reference options 21 or 22 (OSC-1); the procedure is the same for both. The adjustment can be made without the need for opening the case of the instrument. The schedule for recalibration is dependent on the accuracy requirements of the user.

5.4 The remaining calibration adjustments require the opening of the instrument case as described in paragraph 5.14; the recommended schedule for performing the calibration of these adjustments is once every six months.

5.5 SPECIFICATION VALIDATION.

5.6 The need to calibrate the instrument or the accuracy of the instrument following calibration can be determined by referring to the Performance Check provided in Section 3.

5.7 EQUIPMENT REQUIREMENTS.

5.8 A list of equipment required to perform the calibration procedure is provided in table 5.1.

5.9 PRELIMINARY OPERATIONS.

5.10 The following steps must be performed before the calibration procedure is started.

a. Check line voltage.

b. Verify that proper voltage and fuse rating have been selected.

c. Connect the power cord to the line. Set the power switch (PWR) to ON (in) and provide 1/2 hour for temperature stabilization.

d. Refer to the operating manuals for the test equipment to be used and provide appropriate warmup time.

Table 5.1 - Required Equipment

NOTE

Minimum use specifications are the principal parameters required for performance of the calibration, and are included to assist in the selection of alternate equipment, which may be used at the discretion of the calibrating activity. Satisfactory performance of alternate items shall be verified prior to use. All applicable equipment must bear evidence of current calibration.

Item		Minimum Use Specifications	Calibration Equipment
1.	Oscilloscope	Measure 5.2V DC +10%	Tektronix 454
2.	Reference AC Source	5 MHz Traceable to NBS	
3.	UHF RF Source	.1 GHz to 1 GHz, adjustable output 10 to 15 millivolts	
4.	Adjustment Tool	Blade, non-metallic	General Cement 9300

c. Review the procedure and verify that all necessary equipment and hardware are assembled. Preset controls as given below.

INT/EXT Switch	INT
SENSITIVITY	MAX (full clockwise)
PWR Switch	ON (in)
CHK	OFF (out)
HOLD	OFF (out)
RANGE	100 Hz

5.11 Calibration Points.

5.12 The location of the calibration points is shown in figure 5.1. Access to the calibration points requires opening of the case as described in paragraph 5.14.

5.13 Disassembly.

5.14 Access to the interior is not required for recalibration of the internal reference but is required for readjusting the power supply, sensitivity, and trigger level. Disassembly of the counter is as follows:

> WARNING
>
> Removal of covers exposes potentially lethal voltages. Avoid contact with internal electrical connections while unit is connected to AC Power source.

a. Disconnect the power cable from the power line.

b. Set the counter on the bench with the back facing you.

c. Pull back on the two cam-action slide latches, located at the back of the instrument, as you squeeze the top and bottom halves together. They will pop out about 1/8". A cable (situated to your left) internally connects the two halves of the case so proceed with caution from this point.

d. Carefully lift the top half of the case sufficiently to clear the vertical extensions of the bottom rear panel.

e. Going to your left, turn the top over and lay the top on its back beside the bottom half.

f. Reconnect power cable to power line.

5.15 PROCEDURE.

5.16 The calibration procedure is designed to keep the instrument operating within the published specifications for indefinite periods of time. The order of adjustment has been determined to produce the least interaction. For best results therefore, the procedure should be followed as presented.

5.17 Power Supply.

5.18 With an oscilloscope referenced to ECL common (TP-2), probe the ECL plus supply (P4-1) and adjust potentiometer R2 on the power supply board for an oscilloscope reading of +5.2 volts. Remove scope leads.

5.19 CHANNEL A SENSITIVITY.

5.20 Monitor the counter display and adjust potentiometer R43 counterclockwise for a 1 in the last digit of the display.

5.21 Adjust R54 clockwise until the last digit just changes from 1 to 0.

5.22 CHANNEL C TRIGGER CIRCUIT (with Option 41 only).

5.23 Connect F_C input to High Frequency source and set output amplitude of frequency source to 15 millivolts.

5.24 Sweep the frequency output from 100 MHz to 1 GHz and verify that the instrument measures the input across the entire band. If this does not occur, adjust R158 counterclockwise until proper response is achieved.

5.25 CHANNEL C TRIGGER CIRCUIT (Standard Input).

5.26 Perform the procedure covered in paragraphs 5.23 and 5.24 but with an input amplitude of 10 millivolts.

5.27 Reassembly.

5.28 At this point in the procedure, the case is reassembled and described below.

a. Disconnect the power cable from the power line.

b. Replace top half of case on bottom portion using rear panel sections for alignment.

c. Pull the slide latches back to allow the two sections to seat properly. Press firmly on the top of the case toward the front of the instrument and press each of the slide latches in. Reconnect power line.

5.29 FREQUENCY.

(Reference Circuit Used in Earlier Models)

5.30 Connect the output of a 10 MHz source of traceable accuracy to the F_A input. Select the 10 Hz range and adjust potentiometer C19 (accessible at the rear panel OSC ADJ) for an instrument reading of 10.00000. Remove input.

5.31 FREQUENCY (Option 21 or 22).

5.32 Procedure is the same as provided in paragraph 5.30 except that a tuning slug on the TCXO (accessible through a hole in the bottom of the case) is adjusted for a readout of 10.00000.

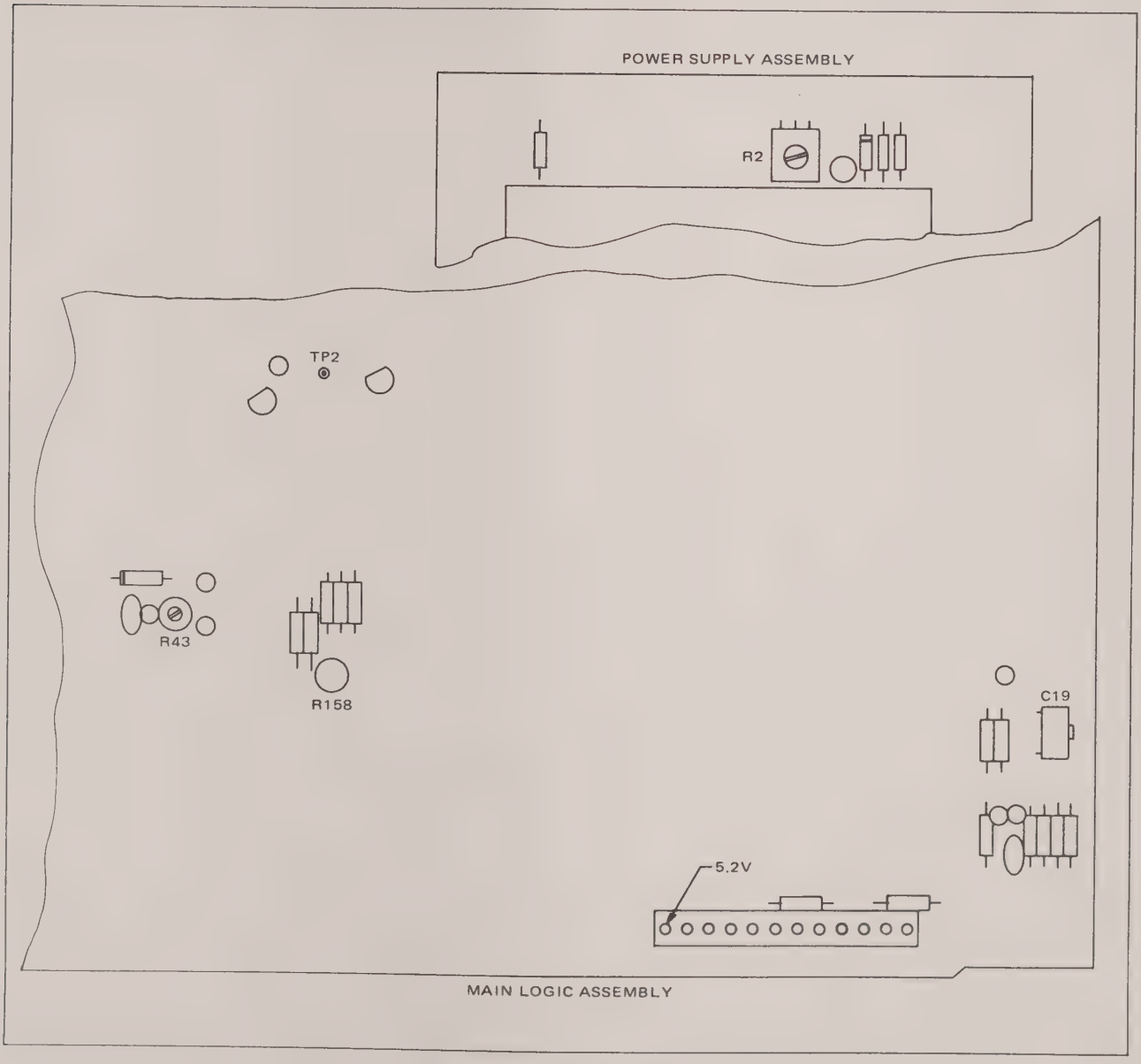


Figure 5.1 - Calibration Points

5.32 BOARD REVISION.

5.33 Every effort is made to keep the manual concurrent with the instrument despite changes to the design, which are an inevitable adjunct of the manufacturing process. The manual is updated and periodically reprinted throughout the year. In between printings, Addendums and Errata Sheets are added to the manual if required to implement the reprinted copy.

5.34 Any design change is accompanied by an updating of a board revision. Such change could be as simple as a revised hole size or as complex as mjaor modifications of the circuitry. The revision of a board is indicated by the letter preceding the assembly number stamped on the board; the revision of the assembly drawing in Section 6 or on an Errata Sheet is indicated by the letter following the assembly number, located below the drawing. Comparing the revision letters can indicate how closely the drawing corresponds to the board.

SECTION 6 DRAWINGS

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6.15	Layout, TCXO-Option 21 or 22 (406727) [Schematic, Main Logic (TCXO-Option 21 or 22) see Figure 6.8, Page 6-12]	6-21
6.16	Layout, Overdrive Protection-Option 41 (406726) [Schematic, Main Logic (Overdrive Protection-Option 41) see Figure 6.7, Page 6-13]	6-22
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6.19	Schematic, BCD Output	6-25
6.20	Assembly, 3-1/2" Rack Mount Kit (Option 60) (403927)	6-26
6.21	Assembly, 5-1/4" Rack Mount Kit (Option 62) (403937)	6-27

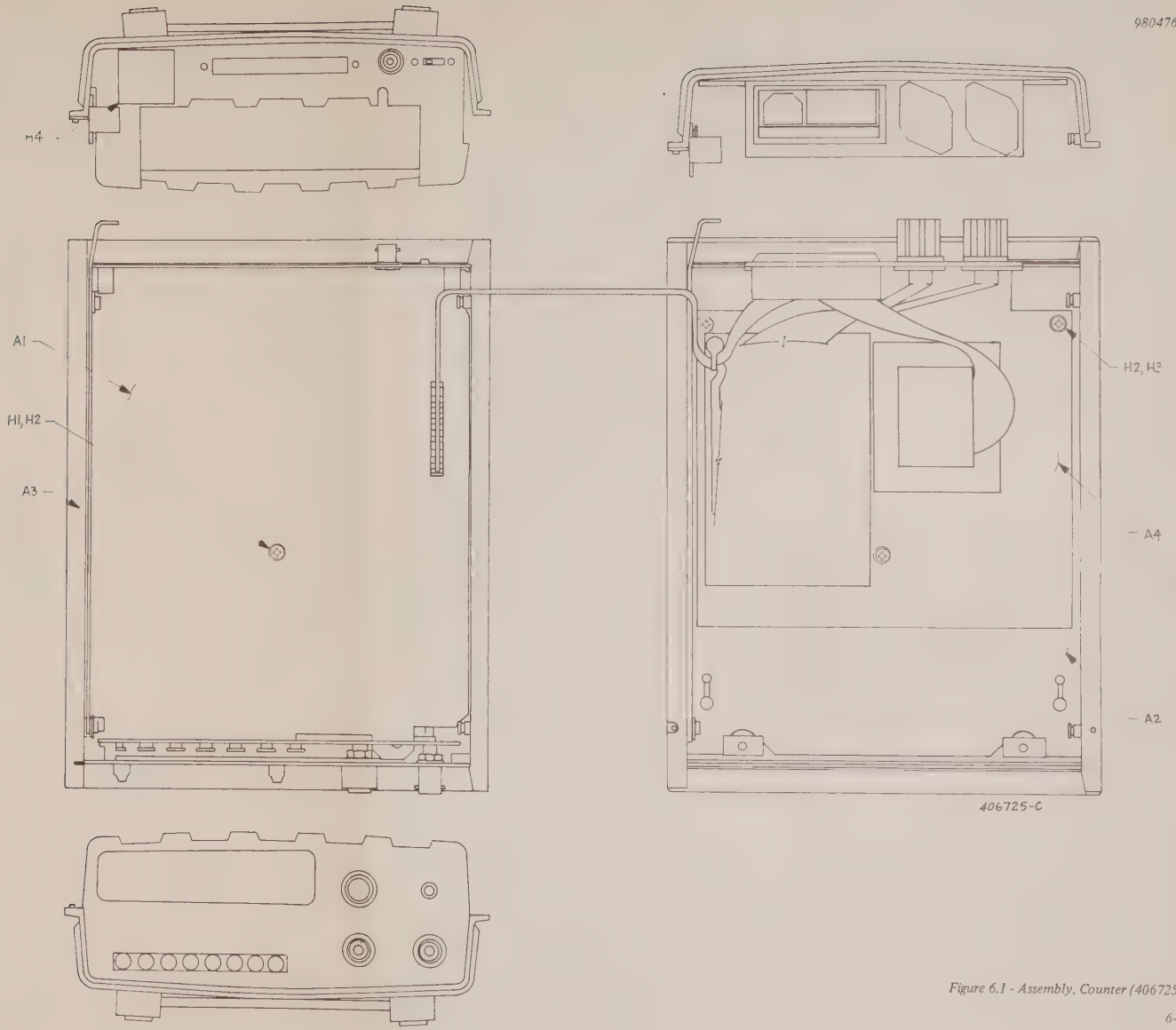
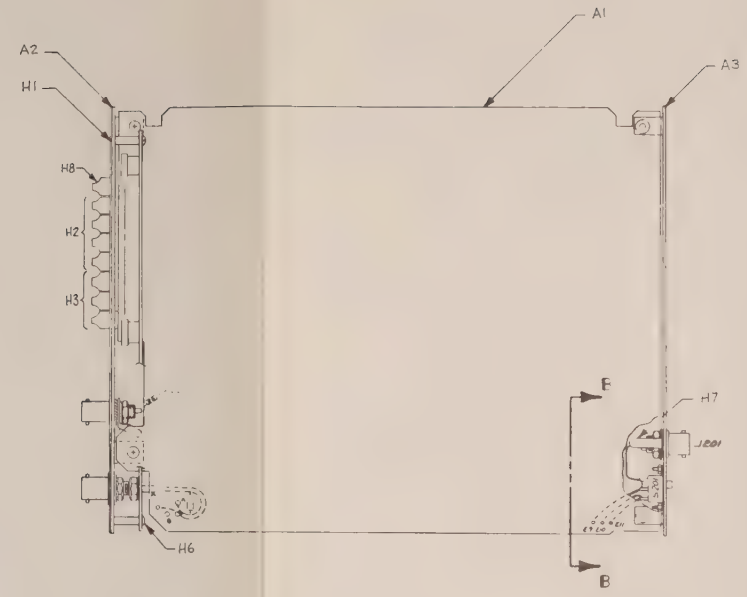


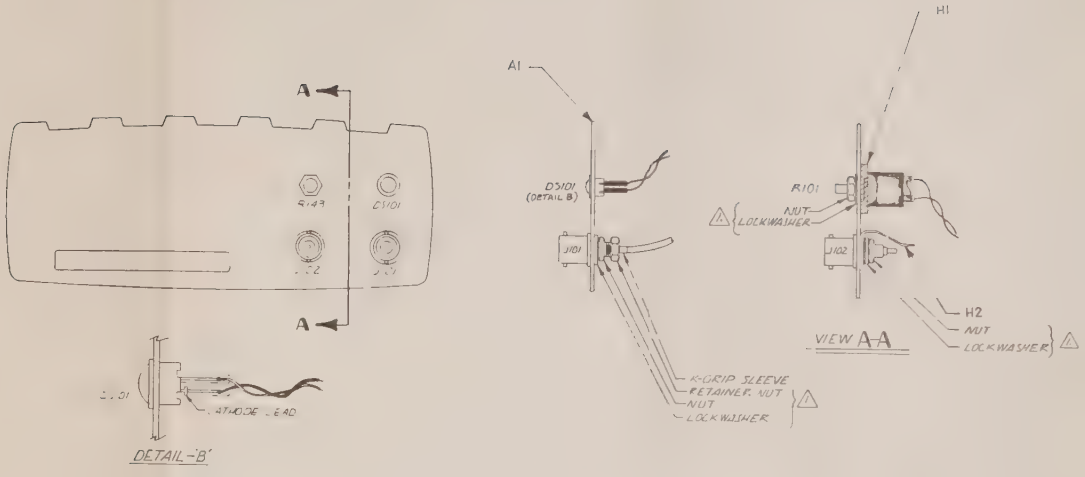
Figure 6.1 - Assembly, Counter (406725)



WIRE LIST

FROM	WIRE	TO
DS101 CATHODE	500132 (REF) 24 AWG TWD. PR. BLACK	E3
DS101 ANODE	500132 (REF) 24 AWG TWD. PR. WHITE	E4
R101-1	500132 24 AWG TWD. PR. WHITE	E2
E [illegible] 3	500023 24 AWG BUSS	[illegible] 2
R101-3	500132 24 AWG TWD. PR. BLACK	E1
J102	RESISTOR LEADS, SHRINK TUBING	E6
J101	501946 REF CABLE RG 188 A/U	FIELD INPUT "A"
J101	CABLE SHIELD	GND
1Z01	500093 24 AWG WHITE	J201-E
J201-2	500023 24 AWG BUSS	J201-3
J201-4	500093 24 AWG WHITE	E9
J201-5	500093 24 AWG WHITE	E11
J201-6	500093 24 AWG WHITE	E10

Figure 6.2 - Assembly, Chassis (406724)



⚠ MOUNTING HARDWARE FOR POT AND BNC CONNECTORS SUPPLIED BY VENDOR.

NOTES: UNLESS OTHERWISE SPECIFIED

406693-E

Figure 6.3 - Layout, Front Panel (406693)

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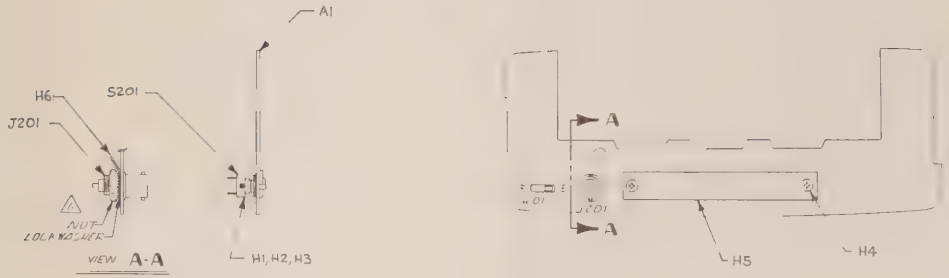
980477



(1) MOUNTING HARDWARE FOR BNC CONNECTOR SUPPLIED BY VENDOR

NOTES: UNLESS OTHERWISE SPECIFIED

406695 D

Figure 6.4 - Layout, Rear Panel (406695)

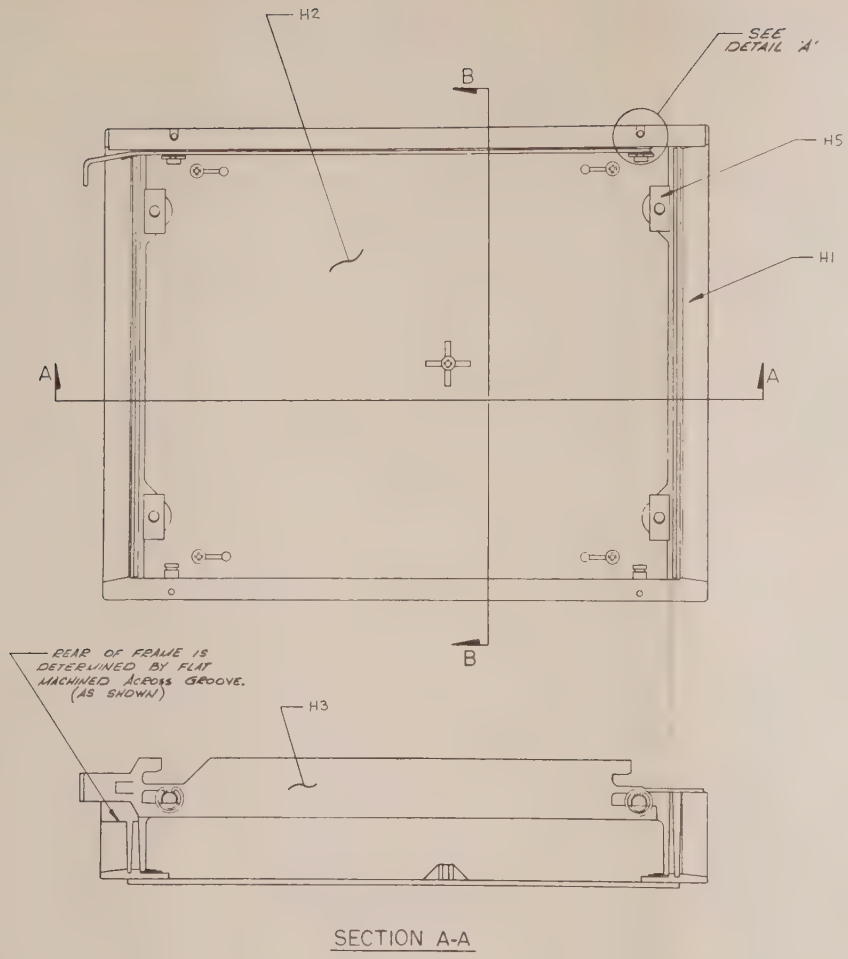


Figure 6.5 - Layout, Top Cover (406719)

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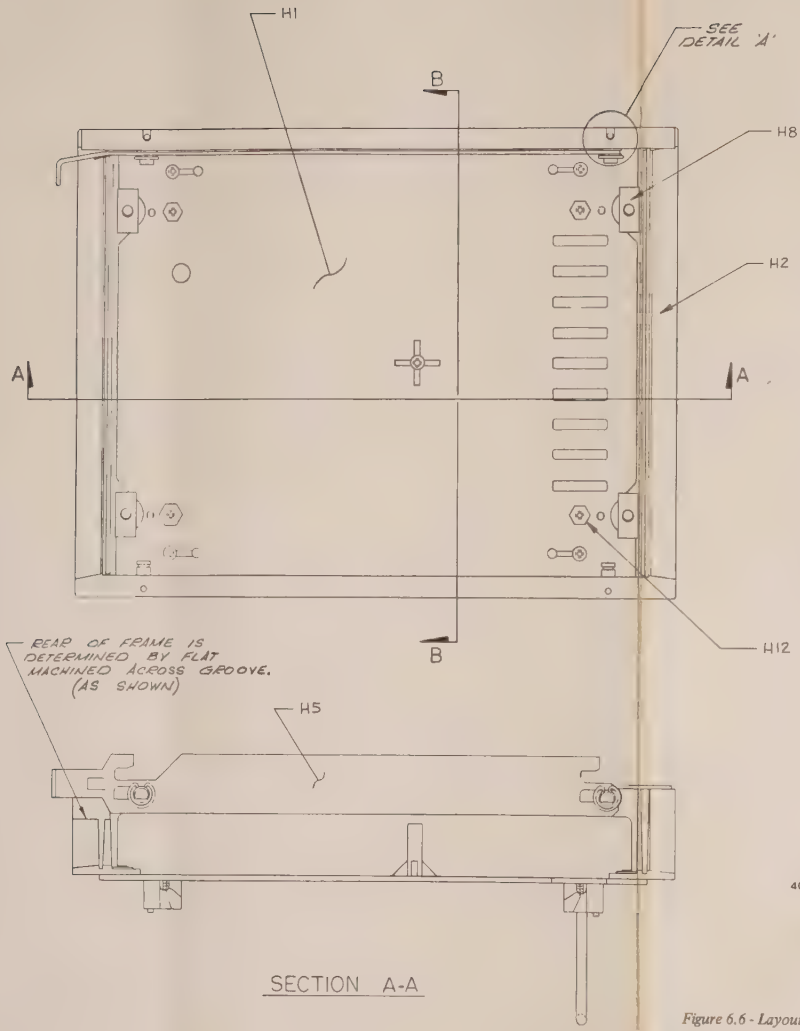
980477



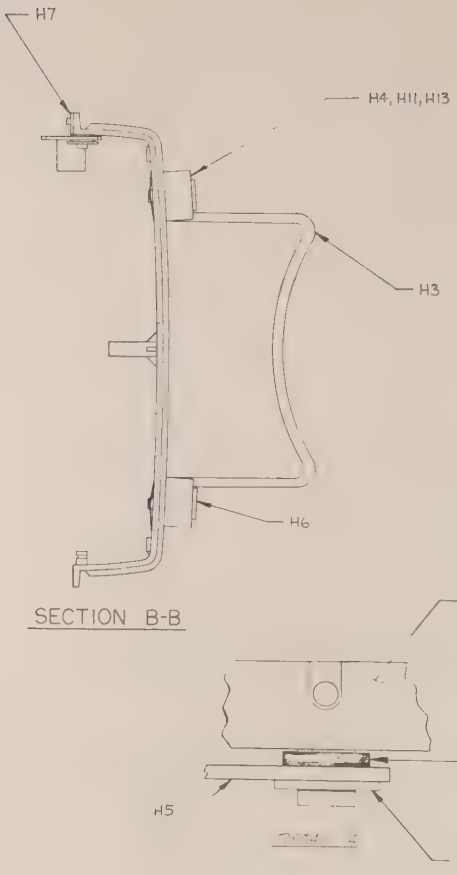


Figure 6.6 - Layout, Bottom Cover (406720)

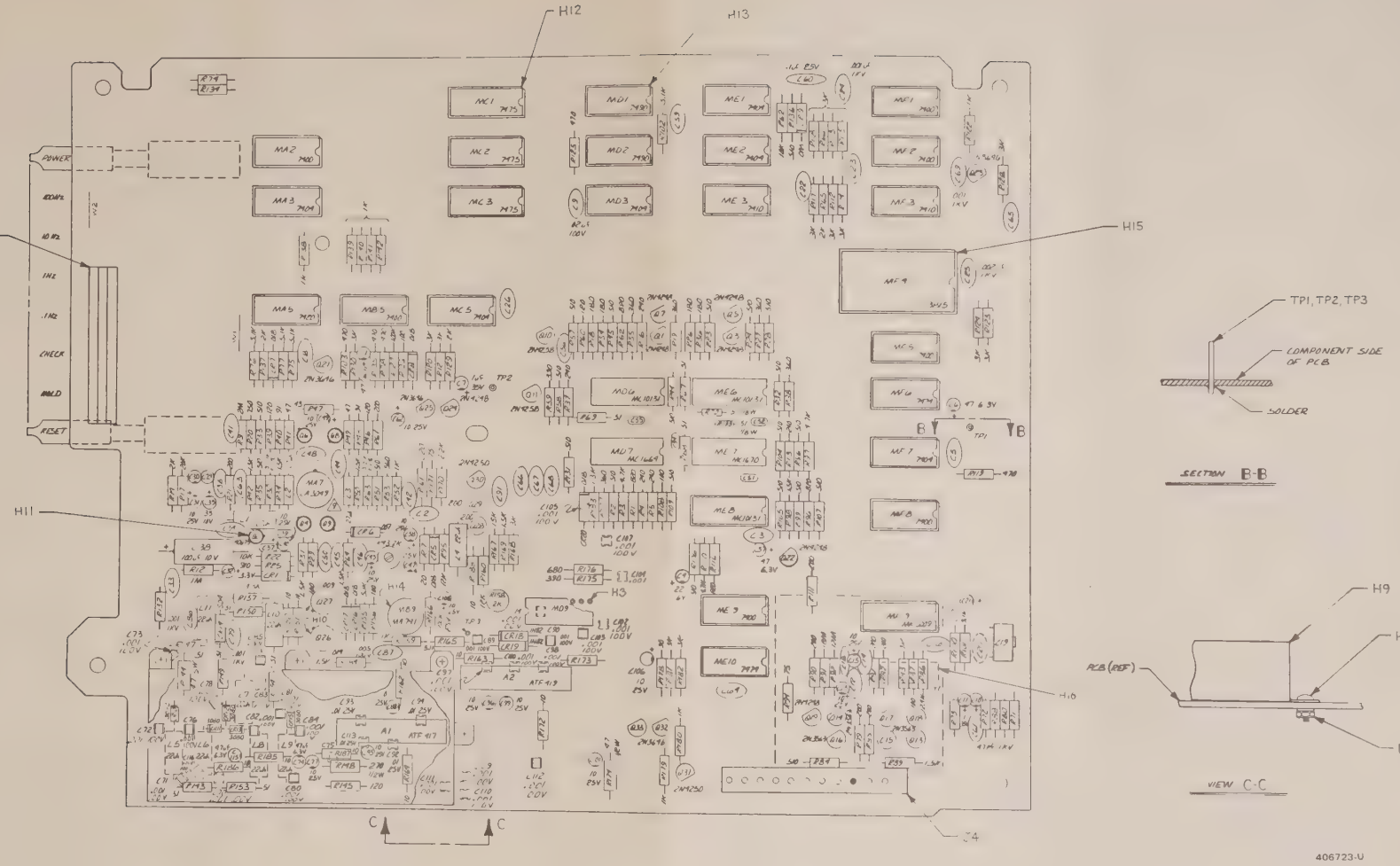


Figure 6.7 - Layout, Main Logic (406723)

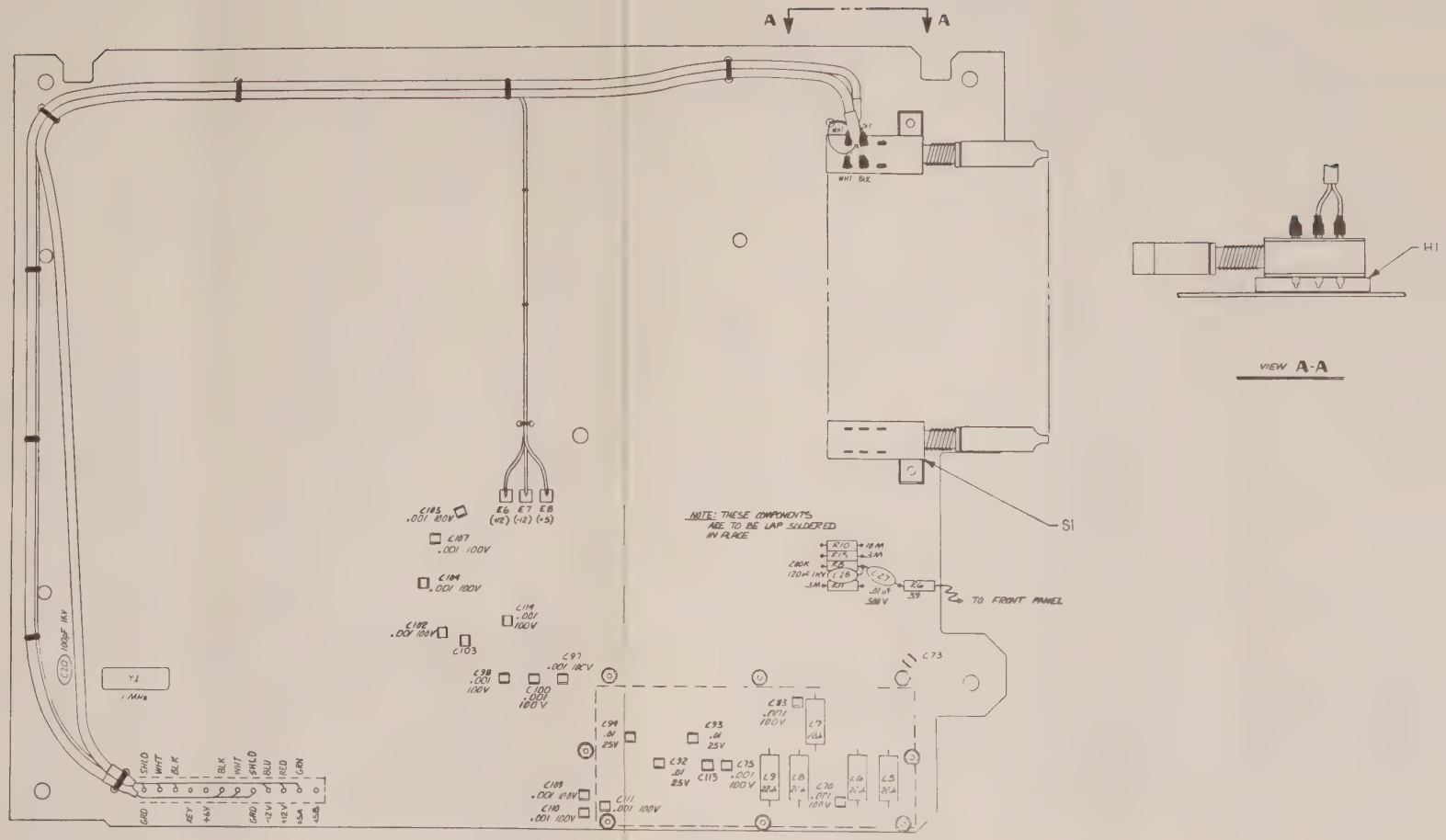
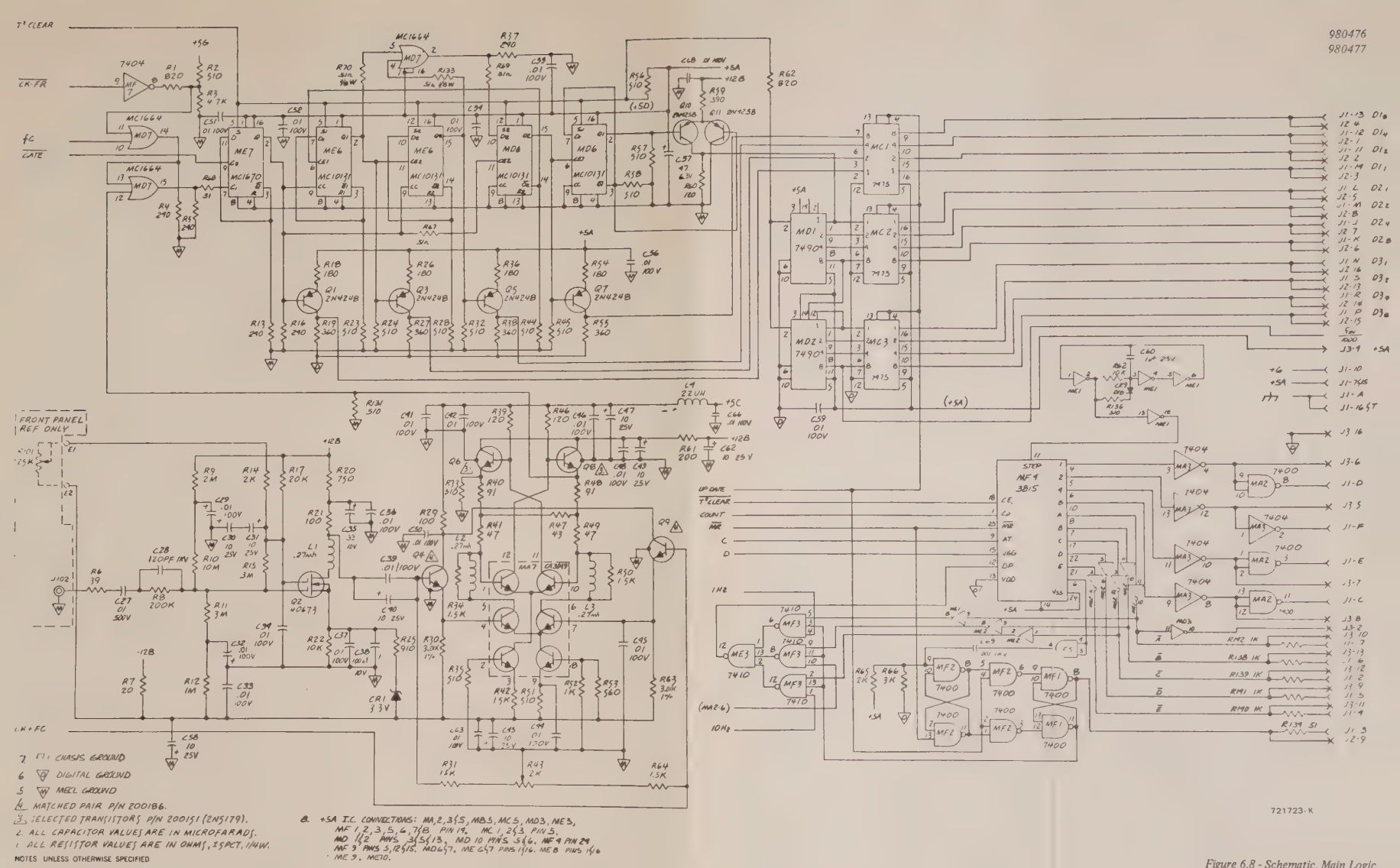


Figure 6.7 - Layout, Main Logic (406723) (continued)


T' CLEAR
CK-FR
fc
CATE
FRONT PANEL REF ONLY
(+SA)
(MA2-6)
10MHz
IN2
UP/DWN
T' CLEAR
COUNT
MR
C
D
7404
7400
7410
7475
7490
MC1664
MC1670
MC10131
MC1664
MC1664
MC1664

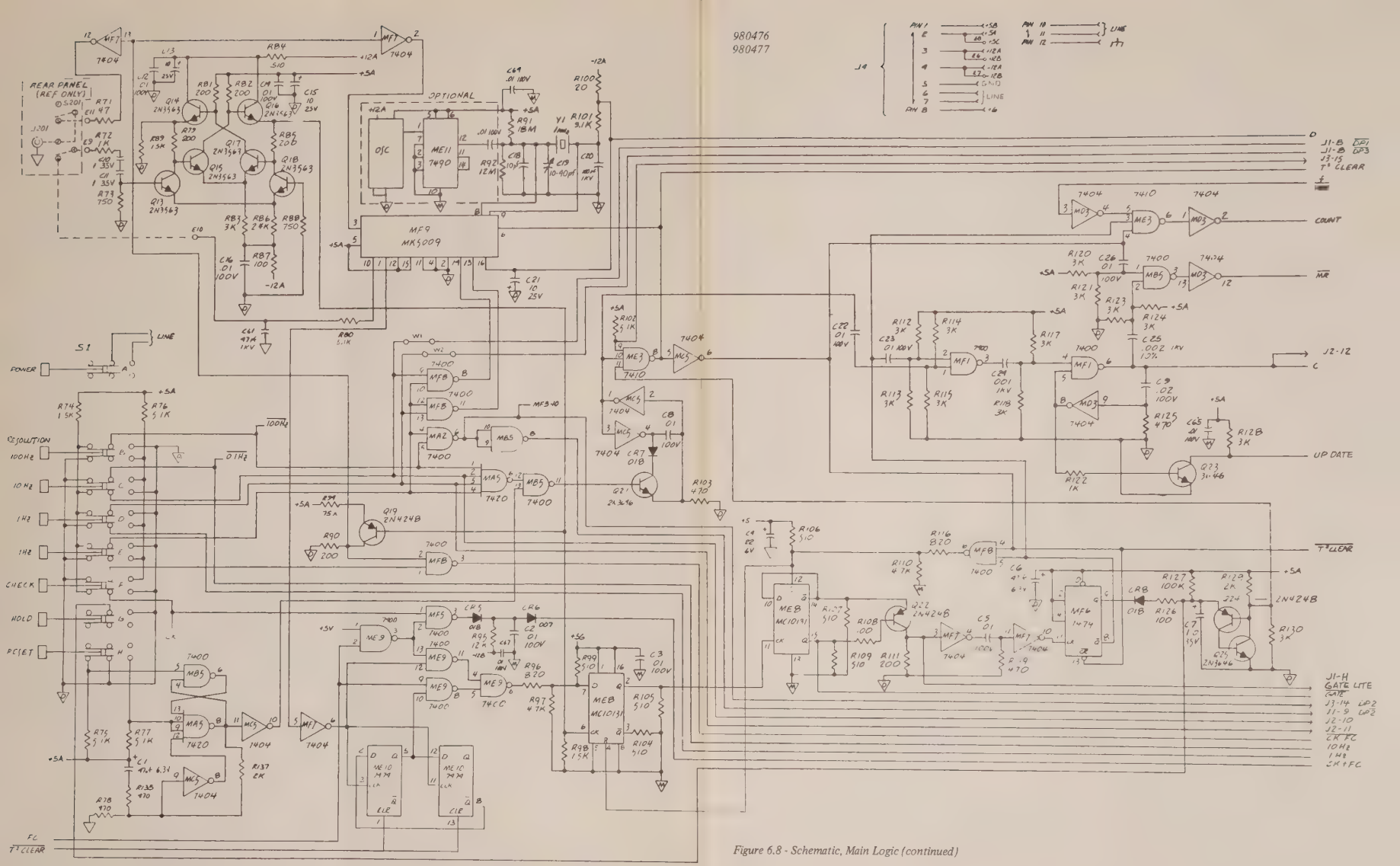


Figure 6.8 - Schematic, Main Logic (continued)

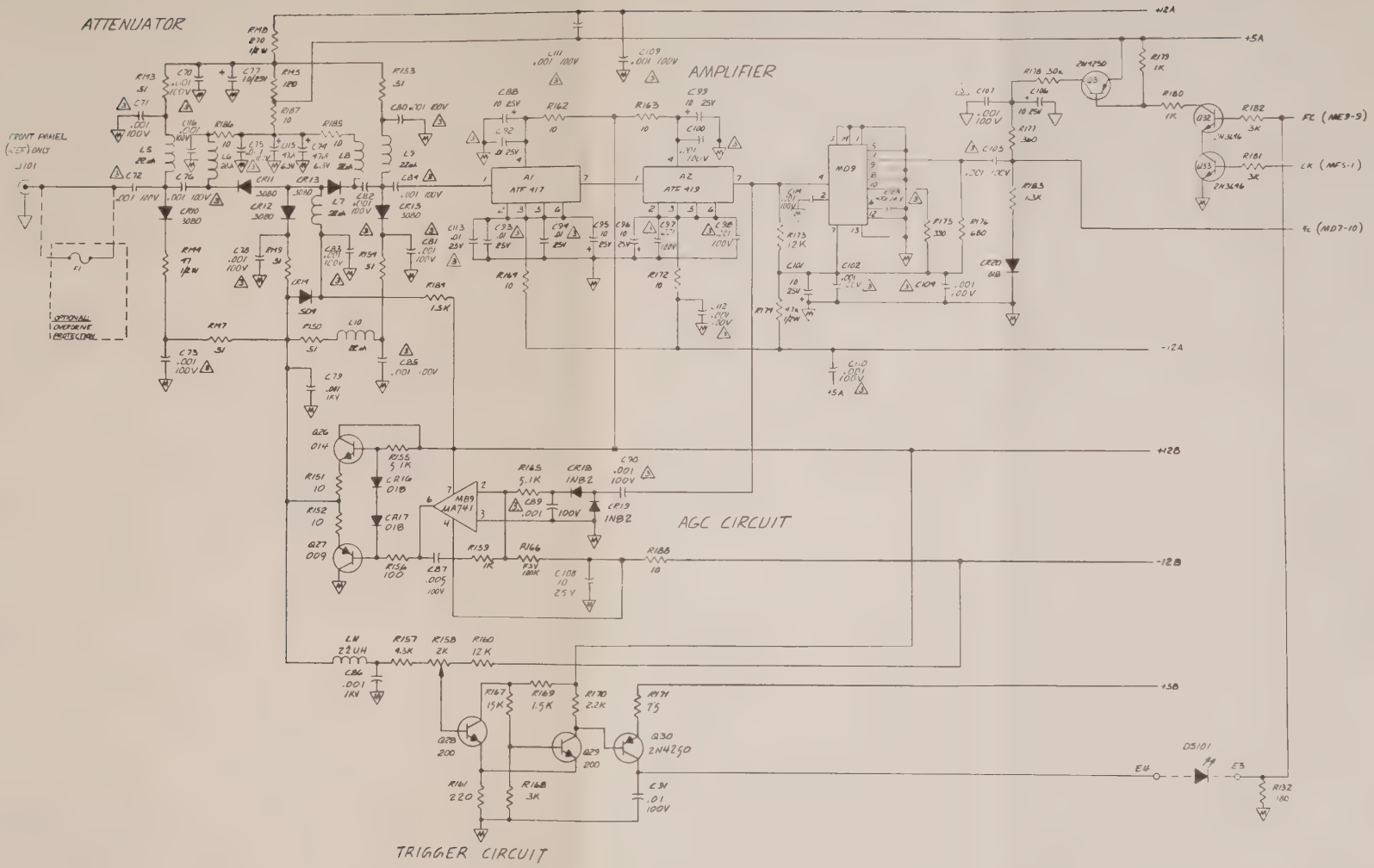
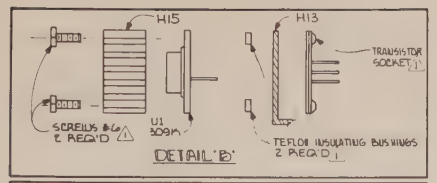
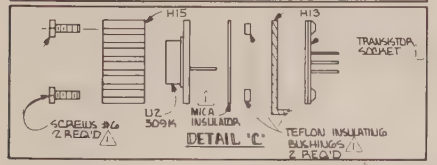
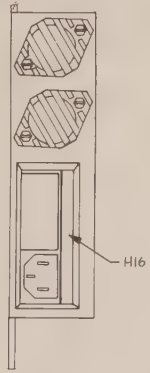


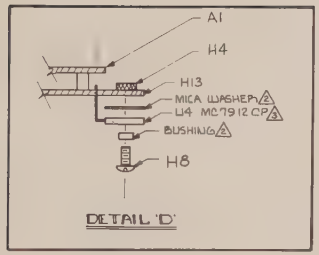
Figure 6.8 - Schematic, Main Logic (continued)

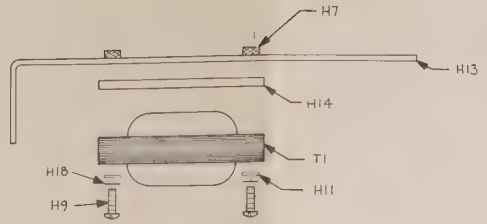
6-13/6-14 Blank

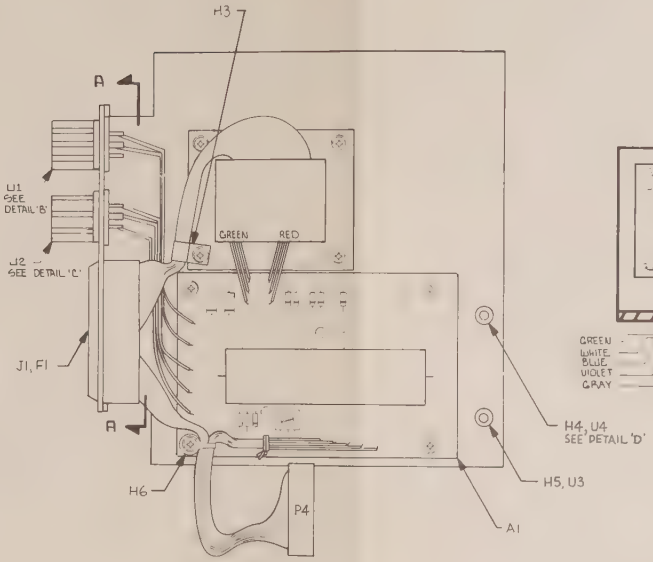


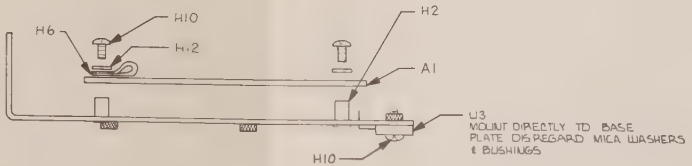


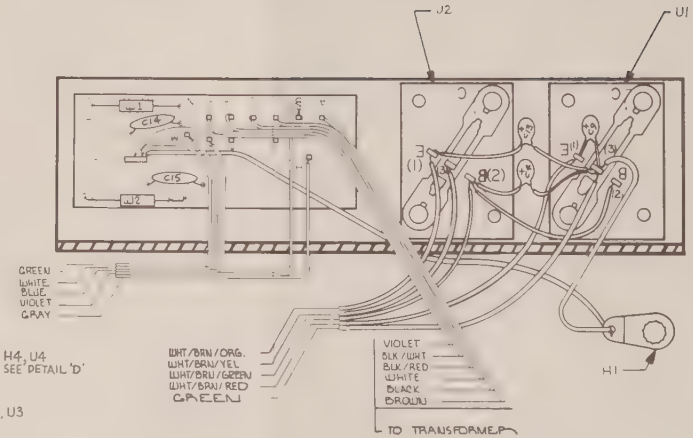












SECTION A-A

406775-E

⚠ AFTER MOUNTING AS SHOWN, SOLDER TRANSISTOR TO A1.

⚠ INCLUDED WITH U3-MC7812CP

⚠ H17 — TRANSISTOR MOUNTING KIT. DISREGARD PARTS IN KIT NOT CALLED-OUT IN DETAILS B & C. NOTE MICA INSULATOR USED ONLY IN DETAIL 'C'. DO NOT USE HEATSINK COMPOUND.

NOTES:

Figure 6.9 - Assembly, Power Supply Module (406775)

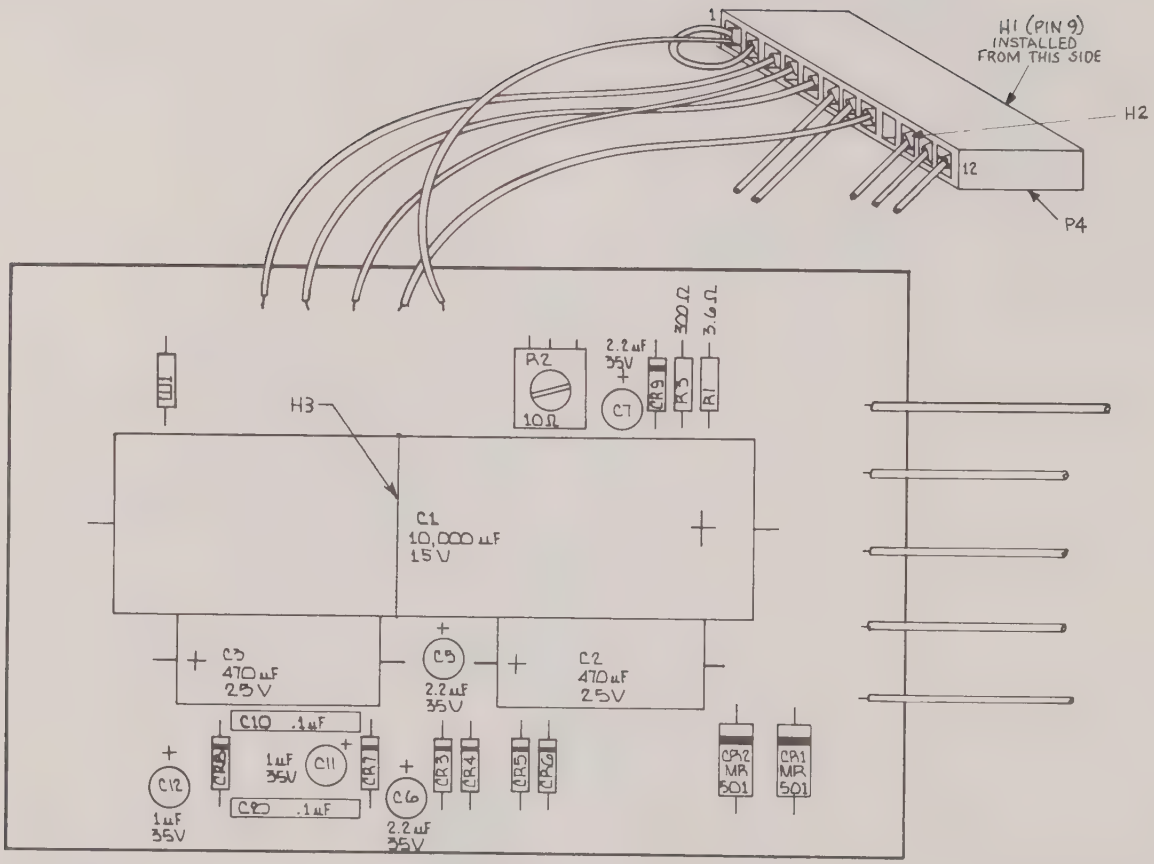


Figure 6.10 - Layout, Power Supply (406762)

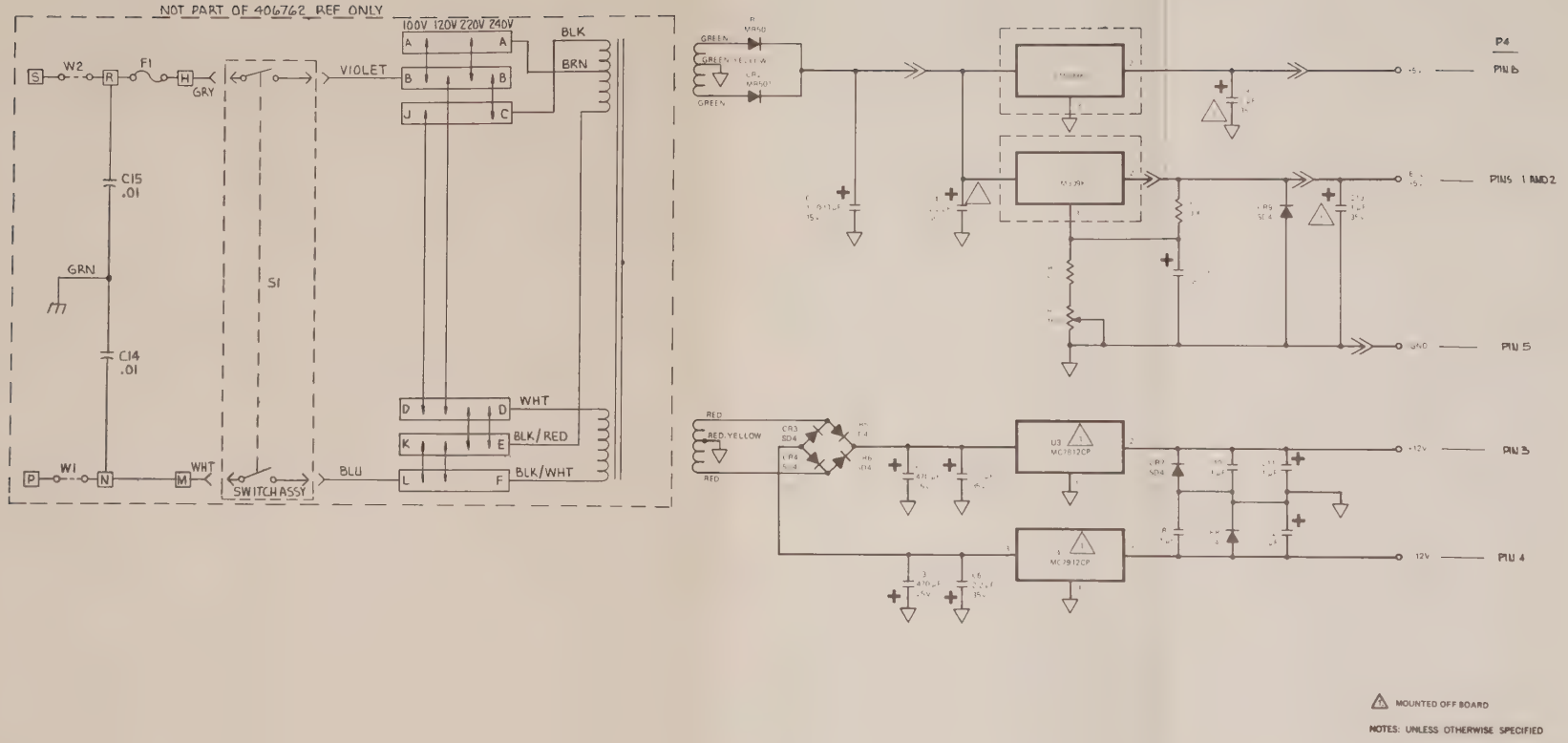


Figure 6.11 - Schematic, Power Supply

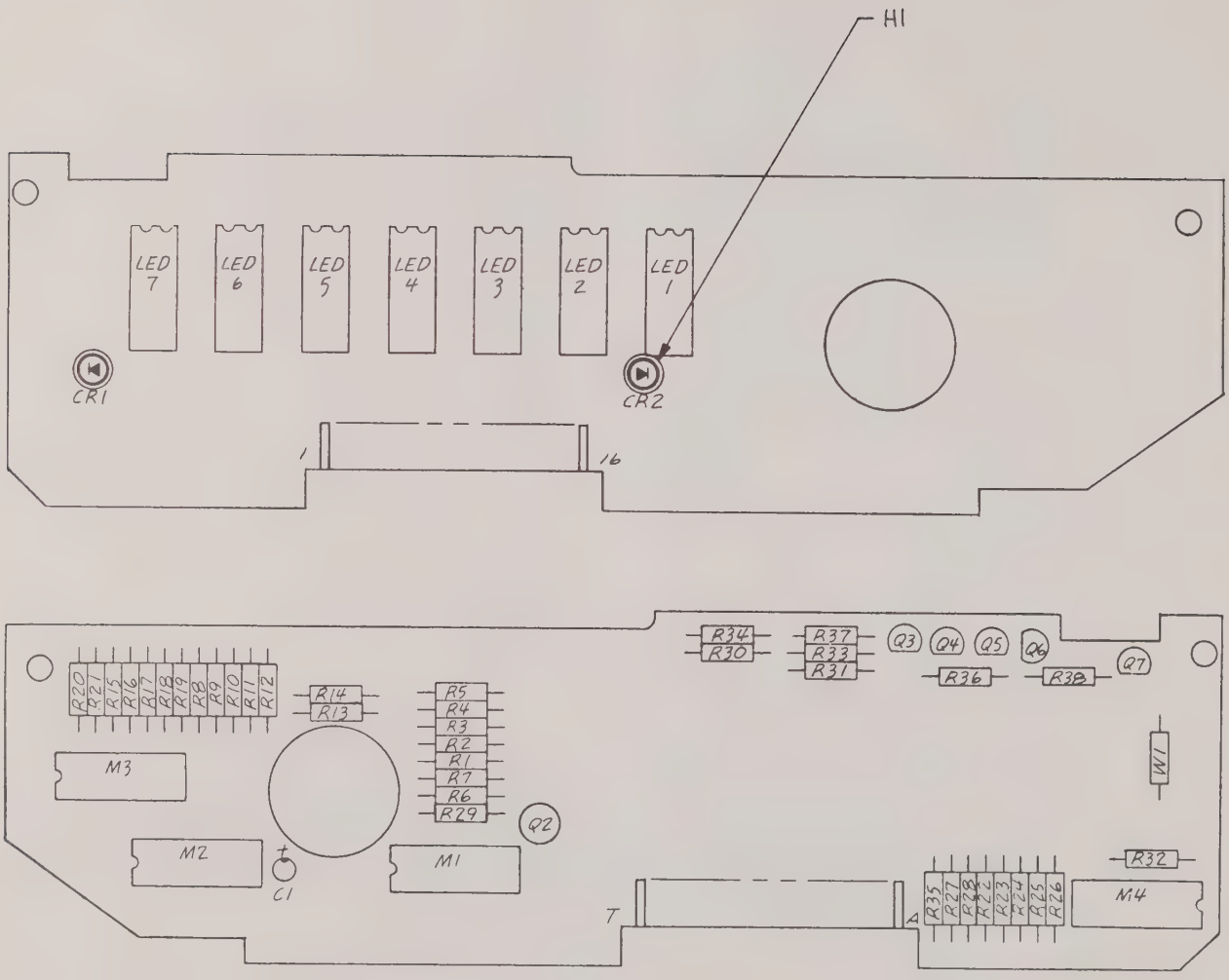
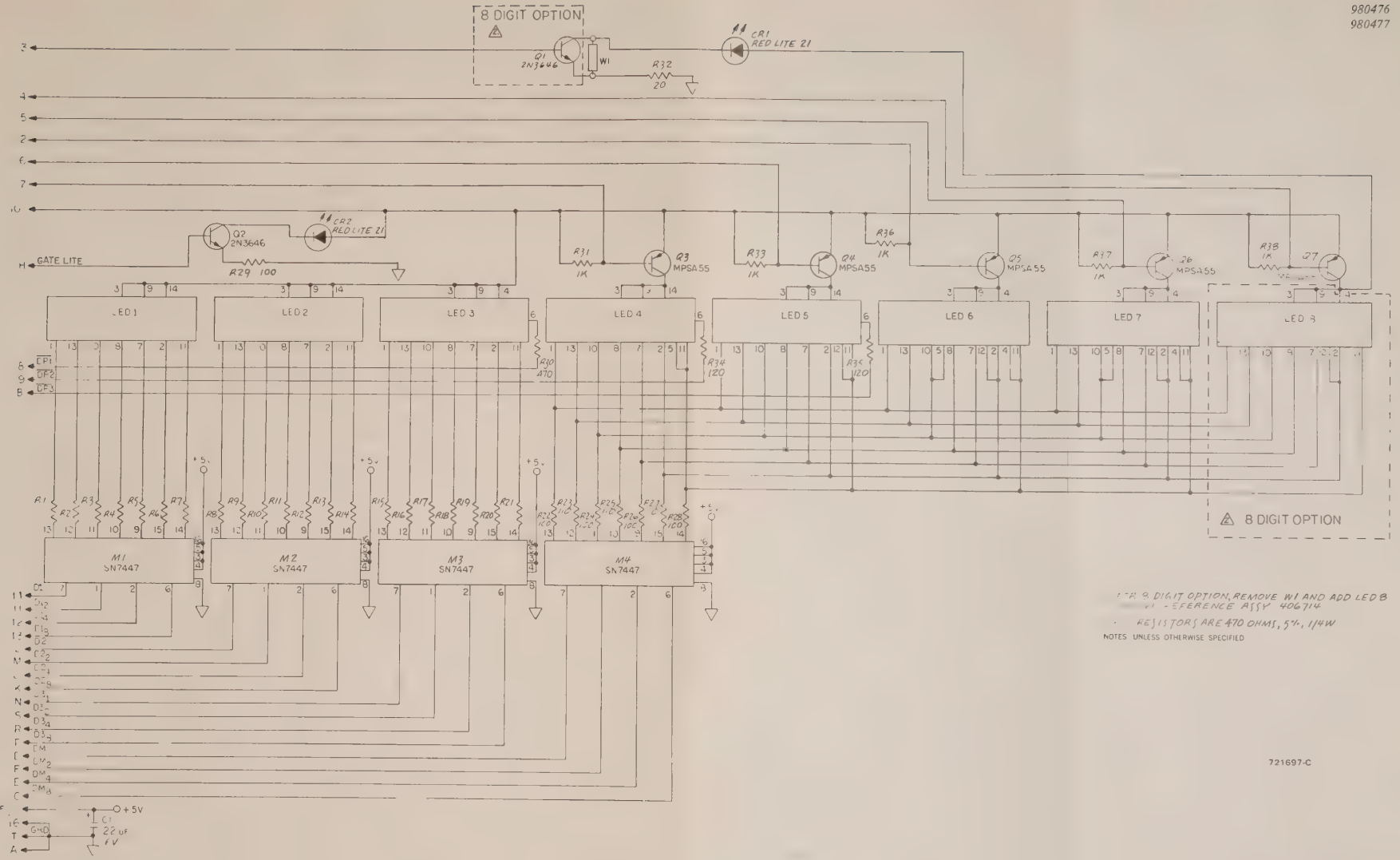


Figure 6.12 - Layout, Display (406697)



FOR 8 DIGIT OPTION, REMOVE W1 AND ADD LED 8 ... -EFERENCE ASSY 406714

. RESISTORS ARE 470 OHMS, 5%, 1/4W

NOTES UNLESS OTHERWISE SPECIFIED

721697-C

Figure 6.13 - Schematic, Display

980476
980477

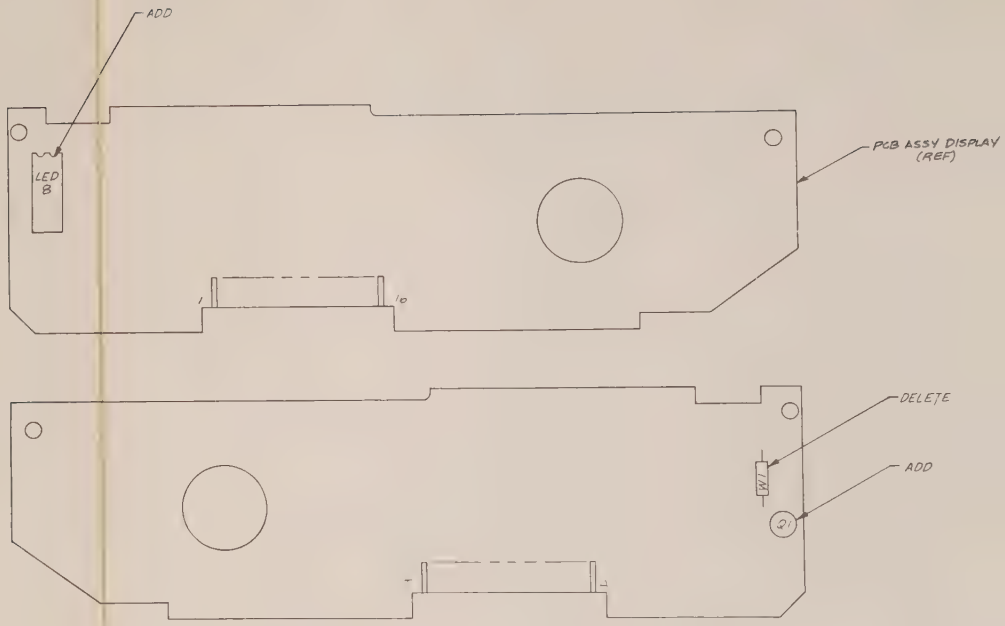
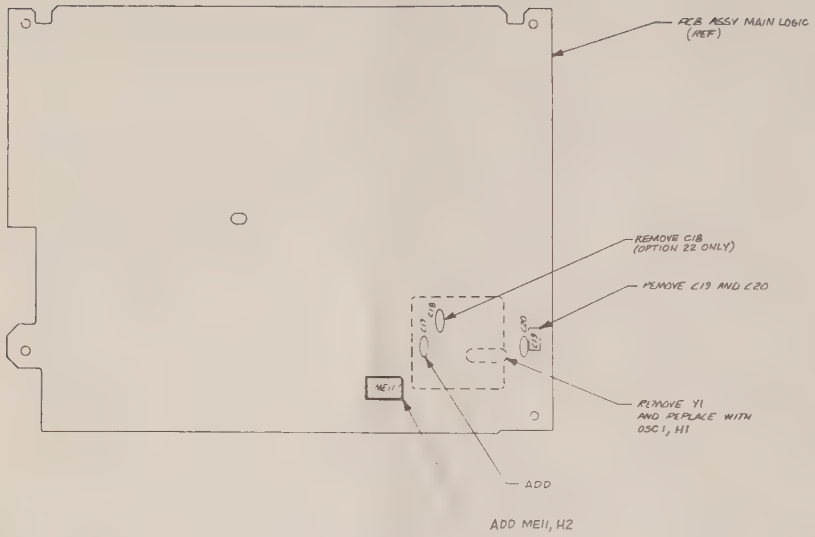
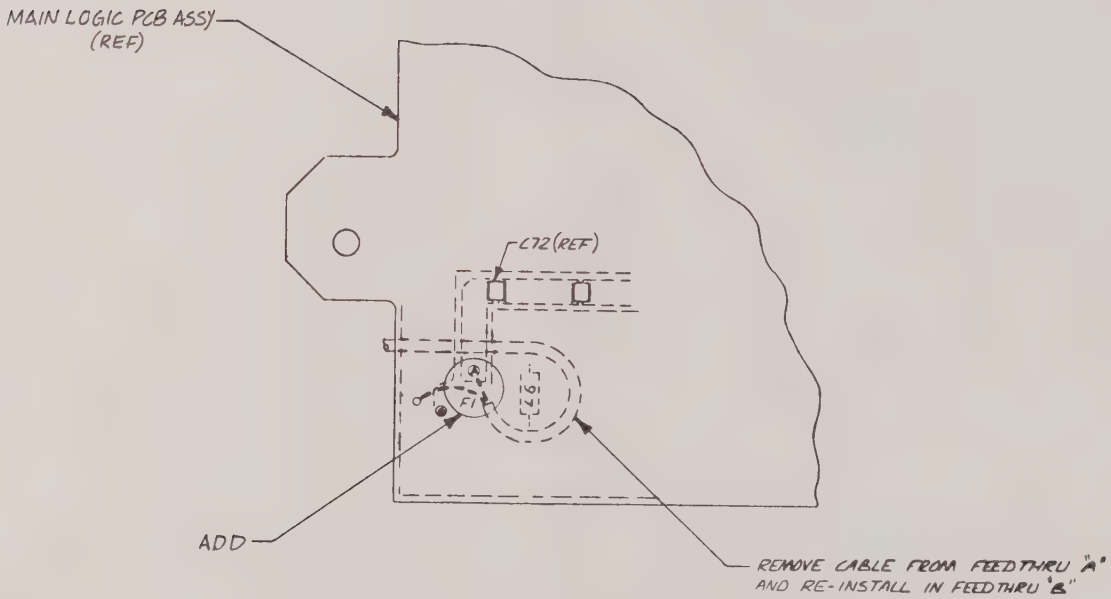


Figure 6.14 - Layout, 8th Digit-Option 08 (406714)



OPTION 21—406727-A
OPTION 22—406841-B

Figure 6.15 - Layout, TCXO-Option 21 or 22



406726-B

Figure 6.16 - Layout, Overdrive Protection-Option 41 (406726)

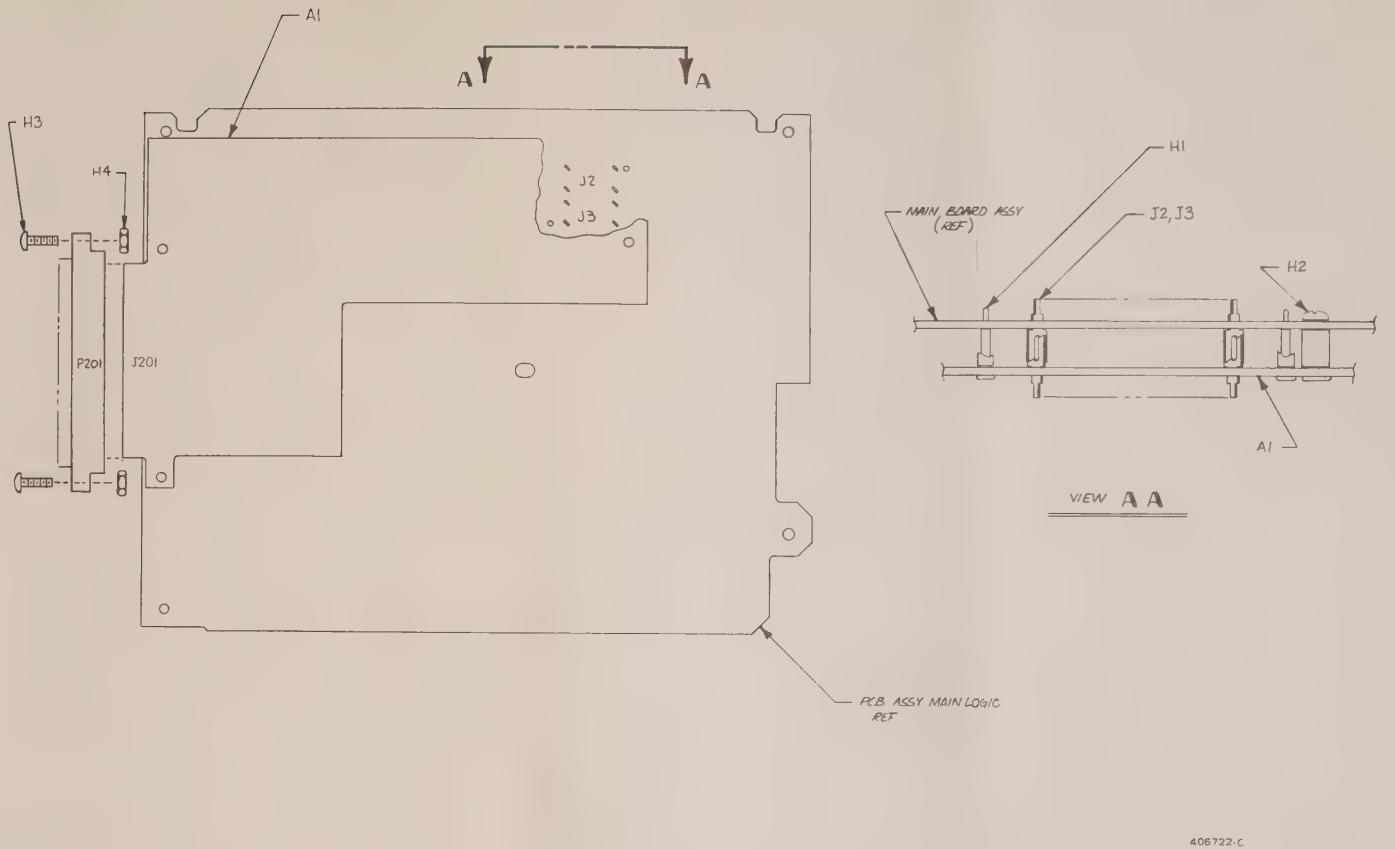


Figure 6.17 - Assembly, BCD Output Modification Kit (406722)

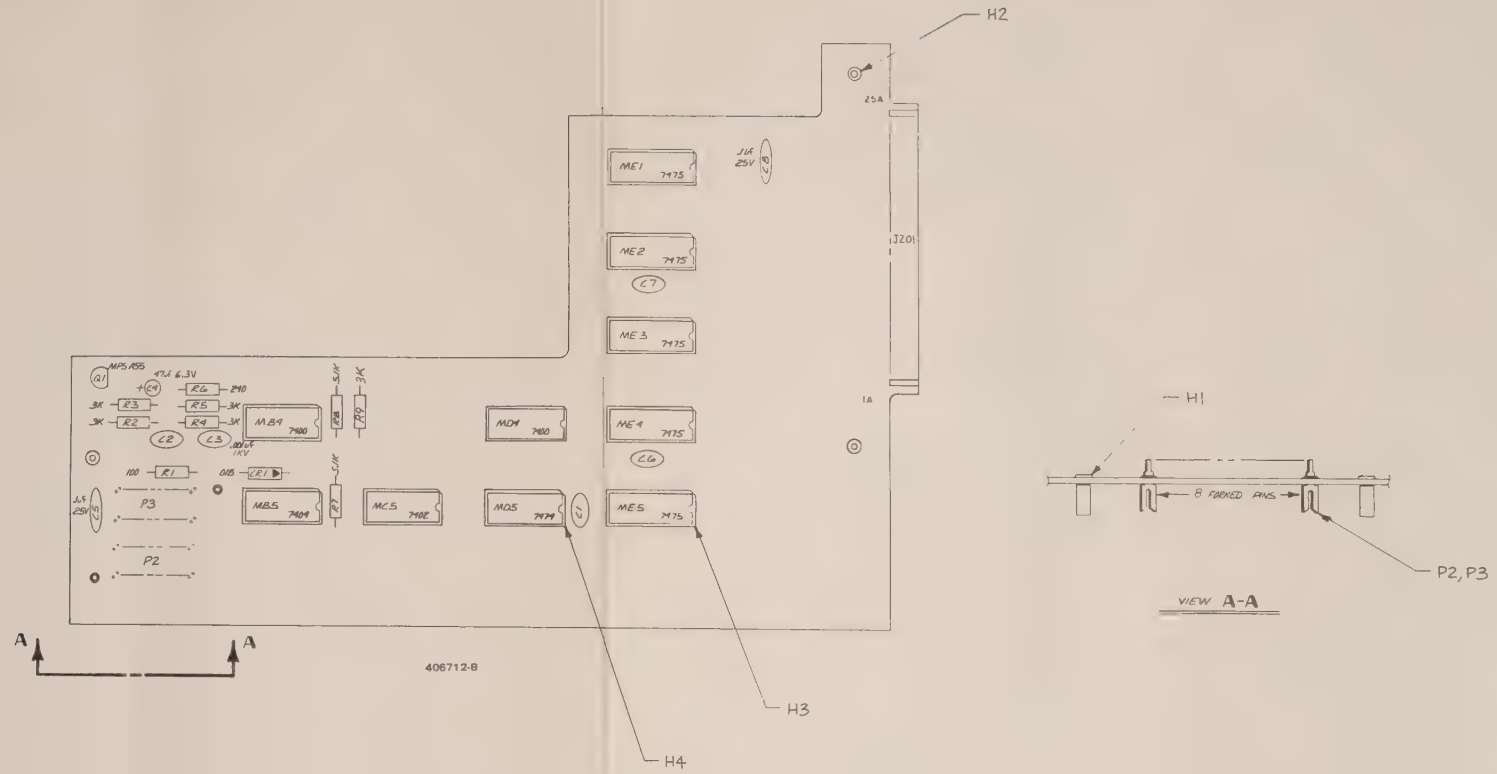
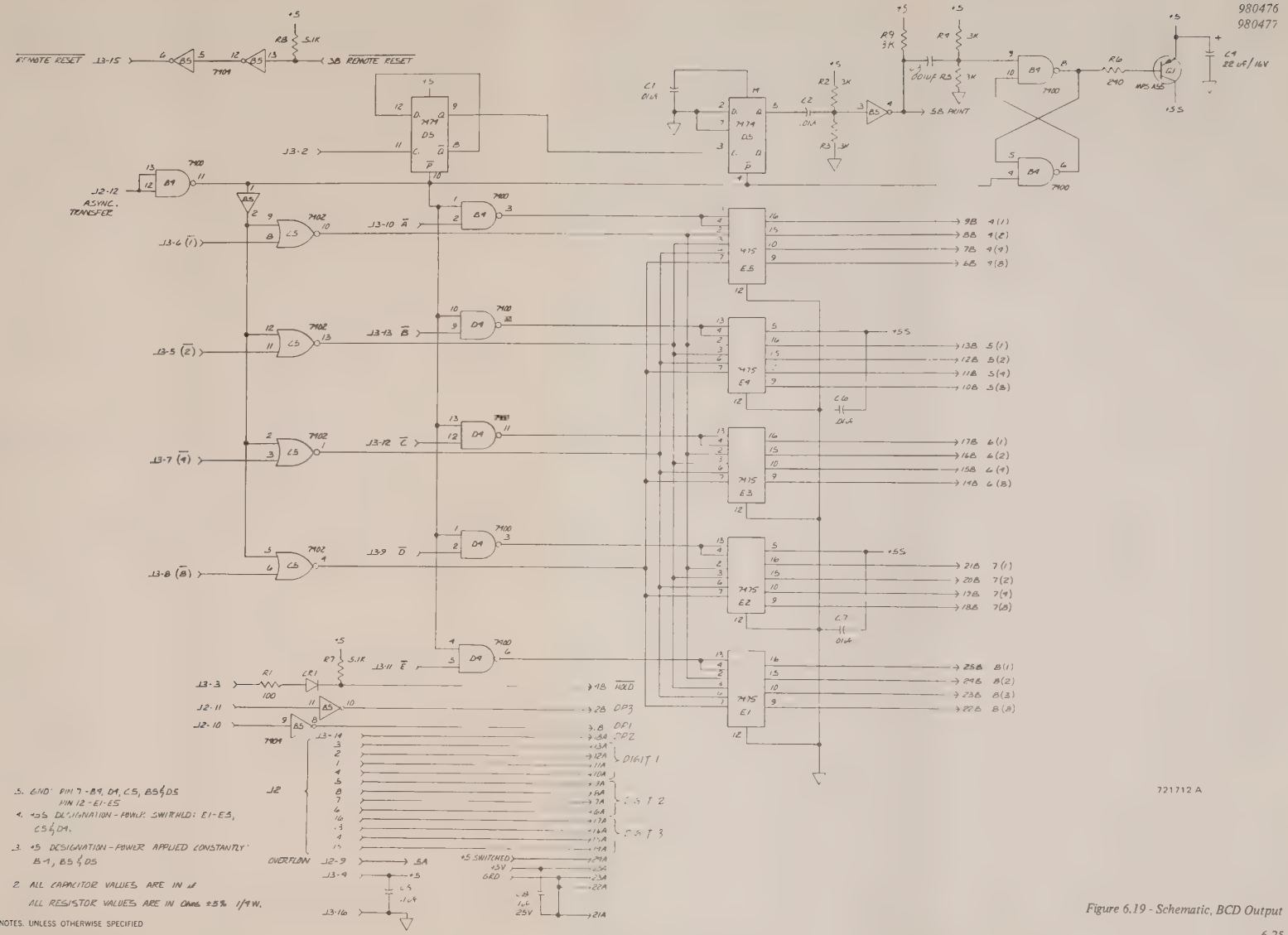


Figure 6.18 - Layout, BCD Output (406712)



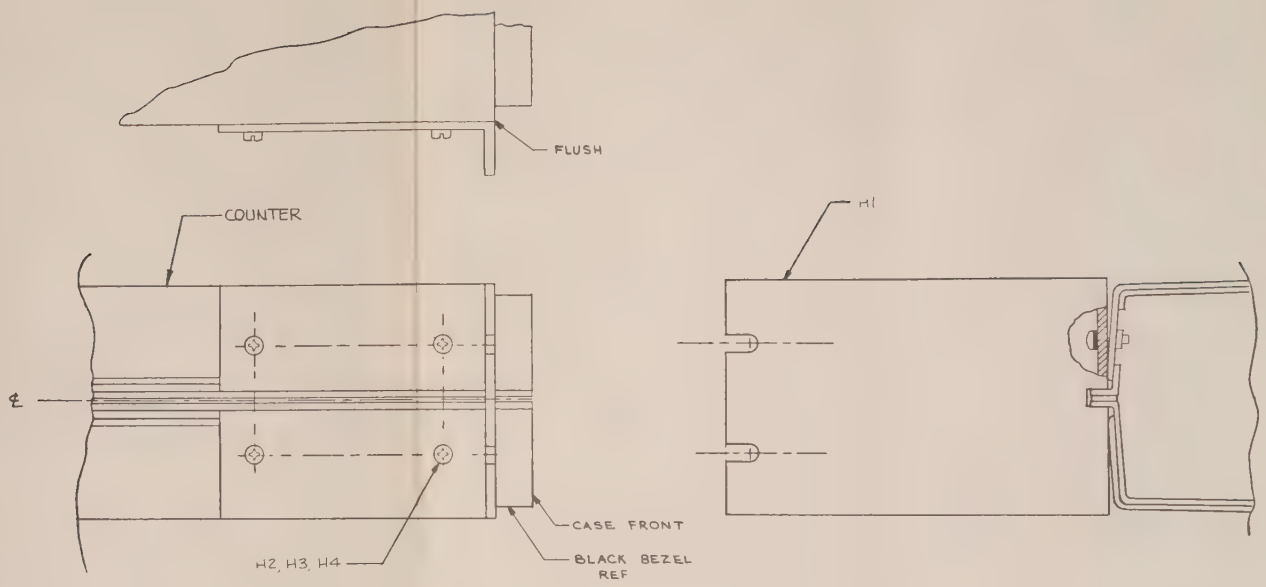
5. GND: PIN 7 - B9, D9, C5, B5 & D5
PIN 12 - E1-E5
4. +5S DESIGNATION - PRIMARY: SWITCHED: E1-E5, C5 & D9.
3. +5 DESIGNATION - POWER APPLIED CONSTANTLY: B-1, B5 & D5
2. ALL CAPACITOR VALUES ARE IN μf
ALL RESISTOR VALUES ARE IN ohms ±5% 1/4 W.

NOTES: UNLESS OTHERWISE SPECIFIED

721712 A

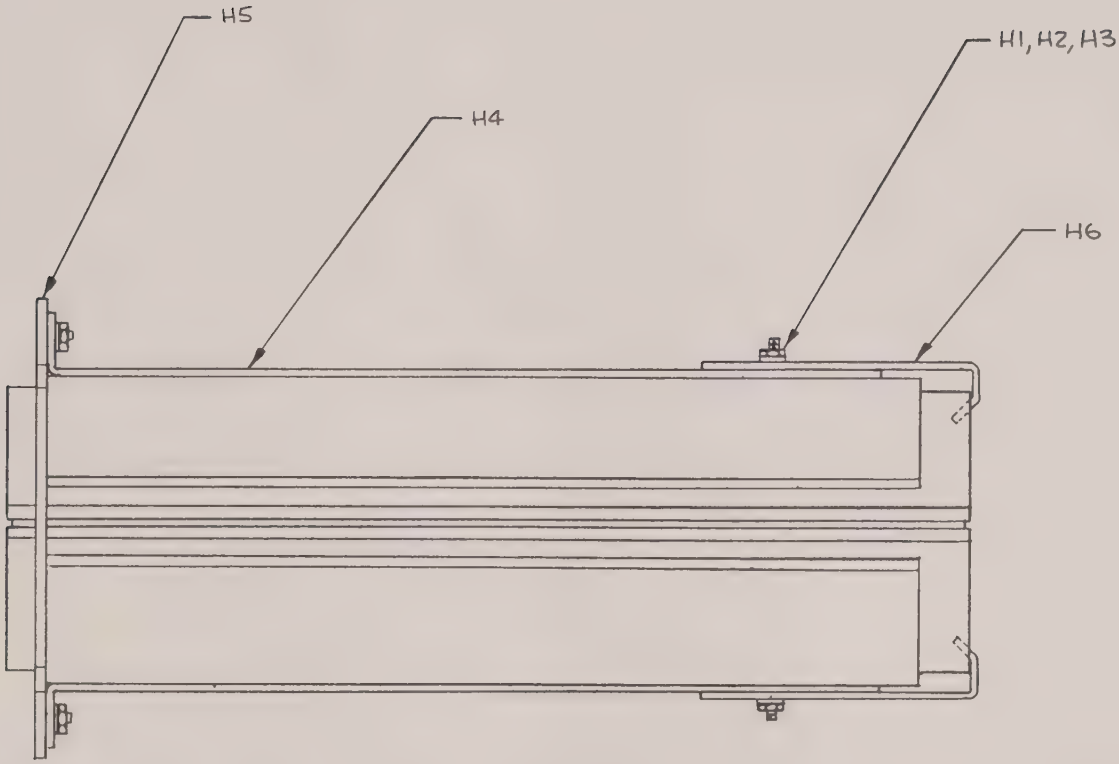
Figure 6.19 - Schematic, BCD Output

980476
980477



FOR INSTALLATION OUTSIDE THE PLANT
SEE PARAGRAPH 2.12, PAGE 2-1

Figure 6.20 - Assembly, 3-1/2" Rack Mount Kit (Option 60) (403927)



403937-B

FOR INSTALLATION OUTSIDE THE PLANT
SEE PARAGRAPH 2.13, PAGE 2-2

Figure 6.21 - Assembly, 5-1/4" Rack Mount Kit (Option 62) (403937)

SECTION 7 PARTS LIST

7.1 This section contains lists of replaceable parts arranged in the order of the following subassemblies:

	Page
Counter	7-3
Chassis	7-4
Front Panel	7-5
Rear Panel	7-6
Top Cover	7-7
Bottom Cover	7-8
Main Logic	7-9
Power Supply Module	7-20
Power Supply	7-21
Display	7-22
8th Digit – Option 08	7-24
TCXO – Option 21	7-25
TCXO – Option 22	7-25
Overdrive Protection – Option 41	7-26
BCD Output Modification Kit	7-27
BCD Output	7-28
Rack Mounting (Option 60)	7-30
Rack Mounting (Option 62)	7-30

7.2 Manufacturers are identified by FSC numbers listed in table 7.2, "List of Suppliers". The code numbers are from the Federal Supply Code for Manufacturers Cataloging Handbooks H4-1, H4-2, and their supplements.

7.3 Certain parts having 21793 (Dana) listed in the "FSC" column are specially-selected semiconductors. For some of these, standard commercial parts will serve as satisfactory replacements. These Dana parts are identified in table 7.1 along with the commercial equivalent.

Table 7.1

Semiconductor Type:	Equivalent:
007 Diode	Fairchild FD300
009 Transistor	Motorola 2N2905
014 Transistor	Motorola 2N3501
018 Diode	Fairchild 1N916B

Table 7.2 - List of Suppliers

FSC	NAME
00779	AMP, INC. HARRISBURG, PENNSYLVANIA
01121	ALLEN BRADLEY CO. MILWAUKEE, WISCONSIN
01295	TEXAS INSTRUMENTS, INC. DALLAS, TEXAS
02660	AMPHENOL CORP. BROADVIEW, ILLINOIS
04222	AEROVOX CORP. (Hi-Q Division) MYRTLE BEACH, SOUTH CAROLINA
04713	MOTOROLA, INC. (Semiconductor Products Division) PHOENIX, ARIZONA
05397	UNION CARBIDE CORP. (Materials Systems Division) CLEVELAND, OHIO
05574	VIKING INDUSTRIES, INC. CHATSWORTH, CALIFORNIA
07047	THE MILTON ROSS CO. SOUTH HAMPTON, PENNSYLVANIA
07263	FAIRCHILD (Semiconductor Division) MOUNTAIN VIEW, CALIFORNIA
09922	BURNDY CORP. NORWALK, CONNECTICUT
11237	CTS KEENE, INC. PASO ROBLES, CALIFORNIA

Table 7.2 - List of Suppliers continued

FSC	NAME
11769	ELCO PACIFIC EL SEGUNDO, CALIFORNIA
21793	DANA LABORATORIES, INC. IRVINE, CALIFORNIA
25403	AMPEREX ELECTRONIC CORP. (Semiconductor & Receiving Tube Division) SLATERSVILLE, RHODE ISLAND
27014	NATIONAL SEMI-CONDUCTOR CORP. SANTA CLARA, CALIFORNIA
27264	MOLEX PRODUCTS CO. DOWNERS GROVE, ILLINOIS
34553	AMPEREX/MEPCO-ELECTRA (Component Division) HAUPPAUGE, NEW YORK
46384	PENN ENGR. & MFG. CORP. DOYLESTOWN, PENNSYLVANIA
50088	MOSTEK CORP. CARROLLTON, TEXAS
50434	HEWLETT-PACKARD CO. (HPA Division) PALO ALTO, CALIFORNIA
50579	LITRONIX, INC. CUPERTINO, CALIFORNIA
52072	CIRCUIT ASSY. CORP. COSTA MESA, CALIFORNIA
52648	PLESSEY MEMORIES SANTA ANA, CALIFORNIA
52763	STETTNER-TRUSH CAZENOVIA, NEW YORK
56289	SPRAGUE ELECTRIC CO. (Pacific Division) LOS ANGELES, CALIFORNIA
58730	THOMAS & BETTS CO. ELIZABETH, NEW JERSEY
71279	CAMBION CAMBRIDGE, MASSACHUSETTS
71400	BUSSMAN MFG. (Division of McGraw & Edison Co.) ST. LOUIS, MISSOURI
71471	AEROVOX CORP. (Cinema Plant) MONCKS CORNER, SOUTH CAROLINA
71785	TRW ELECTRONIC COMPONENTS (Cinch Division) ELK GROVE VILLAGE, ILLINOIS
72982	ERIE TECHNOLOGICAL PRODUCTS, INC. ERIE, PENNSYLVANIA
73138	BECKMAN INSTRUMENTS, INC. FULLERTON, CALIFORNIA
75835	MILTON ROSS WHITTIER, CALIFORNIA
75915	LITTELFUSE, INC. DES PLAINES, ILLINOIS
78553	EATON CORP. (Tinnerman Products, Inc.) CLEVELAND, OHIO
79727	C-W INDUSTRIES WARMINSTER, PENNSYLVANIA
80131	ELECTRONICS INDUSTRIES ASSOC. WASHINGTON, D.C.
81349	MILITARY SPECIFICATION
83330	HERMAN H. SMITH, INC. BROOKLYN, NEW YORK
86797	ROGAN BROTHERS, INC. SKOKIE, ILLINOIS
86884	RCA (Electronics Components Division) HARRISON, NEW JERSEY
86928	SEASTROM MFG. CO. GLENDALE, CALIFORNIA
88245	LITTON PRECISION PROD. VAN NUYS, CALIFORNIA
91836	KINGS ELECTRONICS CO., INC. TUCKAHOE, NEW YORK
95238	CONTINENTAL CONNECTOR WOODSIDE, NEW YORK
98159	RUBBER TECK, INC. GARDENA, CALIFORNIA
98978	INTERNATIONAL ELECTRONIC-RESEARCH CO. (IERC) (Division Dynamics Corp. of America) BURBANK, CALIFORNIA
99800	AMERICAN PRECISION INDUSTRIES, INC. (Delevan Division) EAST AURORA, NEW YORK

406684 – Assy., COUNTER

REF DES	DANA P/N	DESCRIPTION	FSC	MANU P/N
A1	406692	ASSY CHASSIS	21793	406692
A2	406719	ASSY TOP COVER	21793	406719
A3	406720	ASSY BOTTOM COVER	21793	406720
A4	406775	POWER SUPPLY MODULE	21793	406775
A5	403530	ASSY., AC POWER CORD	21793	403530
H1	615058	SCREW, PPH, 6-32 x 5/16 (1*)		
H2	617128	LOCKWASHER, #6 (4*)		
H3	615057	SCREW, PPH, 6-32 x 1/4 (3*)		
H4	920710	SERIAL TAG (1*)		

*Quantity Required

406724 – Assy., CHASSIS

REF DES	DANA P/N	DESCRIPTION	FSC	MANU P/N
A1	406723	Assy., PCB MAIN BOARD	21793	406723
A2	406693	Assy., FRONT PANEL	21793	406693
A3	406695	Assy., REAR PANEL	21793	406695
A4	406697	Assy., PCB DISPLAY	21793	406697
H1	730627	OVERLAY (1*)	21793	730627
H2	453808	PUSHBUTTON – GRAY (4*)	21793	453808
H3	453809	PUSHBUTTON – BLACK (3*)	21793	453809
H4	920688	KNOB (1*)	86797	RB-67-0-M-L-1/8
H5	615057	SCREW, PPH, 6-32 x 1/4 (4*)		
H6	615042	SCREW, PPH, 4-40 x 1/4 (2*)		
H7	600549	SOLDER LUG (1*)	02660	31-759
H8	730662	PUSHBUTTON – GREEN (1*)	21793	730662

*Quantity Required

406693 – Assy., FRONT PANEL

REF DES	DANA P/N	DESCRIPTION	FSC	MANU P/N
A1	730611	SUBPANEL FRONT	21793	730611
DS101	210045	DIODE LED	50579	RL-21
H1	730628	POT SPACER (1*)	21793	730628
H2	600562	SOLDER LUG (1*)	86928	5407
J101	600734	CONN, BNC	91836	KC-19-139
J102	600567	CONN, BNC	02660	31-236
R101	040280	POT CARBON 25 K 10% 1/2W	01121	WA260305253UA

*Quantity Required

406695 – Assy., REAR PANEL

REF DES	DANA P/N	DESCRIPTION	FSC	MANU P/N
A1	730615	REAR PANEL	21793	730615
H1	615514	SCREW, PFH, 2-56 x 5/16 (2*)		
H2	617075	WASHER, INT. LOCK #2 (2*)		
H3	617014	HEX NUT, RADIO, 2-56 (2*)		
H4	615042	SCREW, PPH, 4-40 x 1/4 (2*)		
H5	453861	PLATE, COVER (1*)	21793	453861
H6	600562	SOLDER LUG (1*)	86928	5407
J201	600567	CONN, BNC	02660	31-236
S201	600617	SWITCH, SLIDE DPDT	79727	G126

*Quantity Required

406719 – Assy., TOP COVER

REF DES	DANA P/N	DESCRIPTION	FSC	MANU P/N
H1	453792	FRAME (1*)	21793	453792
H2	453793	TOP COVER (1*)	21793	453793
H3	453806	LATCH (1*)	21793	453806
H4	453813	RUBBER GASKET (1*)	21793	453813
H5	610725	SPEED NUT (4*)	78553	C12005-017
H6	610727	RETAINING RING (2*)		1200-22
H7	610751	SPACER WASHER (2*)	86928	5710-168-40P

*Quantity Required

406720 – Assy., BOTTOM COVER

REF DES	DANA P/N	DESCRIPTION	FSC	MANU P/N
H1	453791	BOTTOM COVER (1*)	21793	453791
H2	453792	FRAME (1*)	21793	453792
H3	453804	BAIL (1*)	21793	453804
H4	453805	FOOT (4*)	21793	453805
H5	453806	LATCH (1*)	21793	453806
H6	453807	INSULATOR, FOOT (4*)	21793	453807
H7	453813	RUBBER GASKET (1*)	21793	453813
H8	610725	SPEED NUT (4*)	78553	C12005-017
H9	610727	RETAINING RING (2*)		1200-22
H10	610751	SPACER WASHER (2*)	86928	5710-168-40P
H11	615115	SCREW, PPH, 6-32 x 9/16 (4*)		
H12	617005	NUT, HEX, 6-32 (4*)		
H13	617128	LOCKWASHER, #6 (4*)		

*Quantity Required

406723 – Assy., PCB, MAIN LOGIC

REF DES	DANA P/N	DESCRIPTION					FSC	MANU P/N
C1	110140	CAP	TANTA	47 MFD	6 V	20%	05397	T368B476M006AS
C2	100017	CAP	CERAM	.01 MFD	100 V	20%	56289	C023B101F103M
C3	100017	CAP	CERAM	.01 MFD	100 V	20%	56289	C023B101F103M
C4	110127	CAP	TANTA	22 MFD	6 V	20%	05397	T368B226M006AS
C5	100017	CAP	CERAM	.01 MFD	100 V	20%	56289	C023B101F103M
C6	110140	CAP	TANTA	47 MFD	6 V	20%	05397	T368B476M006AS
C7	110143	CAP	TANTA	1 MFD	35 V	20%	05397	T368A105M035AS
C8	100017	CAP	CERAM	.01 MFD	100 V	20%	56289	C023B101F103M
C9	100068	CAP	CERAM	.02 MFD	100 V	20%	56289	C023B101H203M
C10	110143	CAP	TANTA	1 MFD	35 V	20%	05397	T368A105M035AS
C11	110143	CAP	TANTA	1 MFD	35 V	20%	05397	T368A105M035AS
C12	100017	CAP	CERAM	.01 MFD	100 V	20%	56289	C023B101F103M
C13	110151	CAP	TANTA	10 MFD	35 V	20%	05397	T362C106M035A
C14	100017	CAP	CERAM	.01 MFD	100 V	20%	56289	C023B101F103M
C15	110151	CAP	TANTA	10 MFD	35 V	20%	05397	T362C106M035A
C16	100017	CAP	CERAM	.01 MFD	100 V	20%	56289	C023B101F103M
C18	100075	CAP	CERAM	10 PFD	1000 V	5%	56289	C030B102E100J
C19	130127	CAP	TRIMMER	10-40 PFD			52763	10S-TRIKO-24N750
C20	100049	CAP	CERAM	100 PFD	1 KV	5%	56289	10TCCT10
C21	110151	CAP	TANTA	10 MFD	35 V	20%	05397	T362C106M035A
C22	100017	CAP	CERAM	.01 MFD	100 V	20%	56289	C023B101F103M
C23	100017	CAP	CERAM	.01 MFD	100 V	20%	56289	C023B101F103M
C24	100071	CAP	CERAM	.001 MFD	1 KV	20%	56289	C023B102E102M
C25	100019	CAP	CERAM	.002 MFD	1 KV	10%	56289	C023B102F202M
C26	100017	CAP	CERAM	.01 MFD	100 V	20%	56289	C023B101F103M
C27	100063	CAP	CERAM	.01 MFD	500 V	20%	56289	C023B501E103M
C28	100018	CAP	CERAM	120 PFD	1 KV	10%	71471	ETCD(N5600)
C29	100017	CAP	CERAM	.01 MFD	100 V	20%	56289	C023B101F103M
C30	110151	CAP	TANTA	10 MFD	35 V	20%	05397	T362C106M035A
C31	110151	CAP	TANTA	10 MFD	35 V	20%	05397	T362C106M035A
C32	100017	CAP	CERAM	.01 MFD	100 V	20%	56289	C023B101F103M
C33	100017	CAP	CERAM	.01 MFD	100 V	20%	56289	C023B101F103M
C34	100017	CAP	CERAM	.01 MFD	100 V	20%	56289	C023B101F103M
C35	110159	CAP	TANTA	33 MFD	10 V	10%	05397	T368B336K010AS
C36	100017	CAP	CERAM	.01 MFD	100 V	20%	56289	C023B101F103M
C37	100062	CAP	CERAM	.01 MFD	100 V	10%	72982	8121-100-W5R0-103K
C38	110006	CAP	TANTA	100 MFD	10 V	10%	05397	T310C107K010AS
C39	100062	CAP	CERAM	.01 MFD	100 V	10%	72982	8121-100-W5R0-103K
C40	110151	CAP	TANTA	10 MFD	35 V	20%	05397	T362C106M035A
C41	100017	CAP	CERAM	.01 MFD	100 V	20%	56289	C023B101F103M

406723 – Assy., PCB, MAIN LOGIC *continued*

REF DES	DANA P/N	DESCRIPTION					FSC	MANU P/N
C42	100017	CAP	CERAM	.01 MFD	100 V	20%	56289	C023B101F103M
C43	110151	CAP	TANTA	10 MFD	35 V	20%	05397	T362C106M035A
C44	100017	CAP	CERAM	.01 MFD	100 V	20%	56289	C023B101F103M
C45	100017	CAP	CERAM	.01 MFD	100 V	20%	56289	C023B101F103M
C46	100017	CAP	CERAM	.01 MFD	100 V	20%	56289	C023B101F103M
C47	110151	CAP	TANTA	10 MFD	35 V	20%	05397	T362C106M035A
C48	100017	CAP	CERAM	.01 MFD	100 V	20%	56289	C023B101F103M
C49	110151	CAP	TANTA	10 MFD	35 V	20%	05397	T362C106M035A
C50	100017	CAP	CERAM	.01 MFD	100 V	20%	56289	C023B101F103M
C51	100062	CAP	CERAM	.01 MFD	100 V	10%	72982	8121-100-W5R0-103K
C52	100062	CAP	CERAM	.01 MFD	100 V	10%	72982	8121-100-W5R0-103K
C54	100062	CAP	CERAM	.01 MFD	100 V	10%	72982	8121-100-W5R0-103K
C55	100062	CAP	CERAM	.01 MFD	100 V	10%	72982	8121-100-W5R0-103K
C56	100017	CAP	CERAM	.01 MFD	100 V	20%	56289	C023B101F103M
C57	110140	CAP	TANTA	47 MFD	6 V	20%	05397	T368B476M006AS
C58	110151	CAP	TANTA	10 MFD	35 V	20%	05397	T362C106M035A
C59	100017	CAP	CERAM	.01 MFD	100 V	20%	56289	C023B101F103M
C60	100024	CAP	CERAM	.1 MFD	25 V		72982	5815-000Y5U104Z
C61	100102	CAP	CERAM	47 PFD	1 KV	5%	56289	C030B102H470J
C62	110151	CAP	TANTA	10 MFD	35 V	20%	05397	T362C106M035A
C63	100017	CAP	CERAM	.01 MFD	100 V	20%	56289	C023B101F103M
C64	100017	CAP	CERAM	.01 MFD	100 V	20%	56289	C023B101F103M
C65	100017	CAP	CERAM	.01 MFD	100 V	20%	56289	C023B101F103M
C66	100017	CAP	CERAM	.01 MFD	100 V	20%	56289	C023B101F103M
C67	100017	CAP	CERAM	.01 MFD	100 V	20%	56289	C023B101F103M
C68	100017	CAP	CERAM	.01 MFD	100 V	20%	56289	C023B101F103M
C69	100071	CAP	CERAM	.001 MFD	1 KV	20%	56289	C023B102E102M
C70	130104	CAP	CERAM	1000 PFD	100 V	20%	72982	9ACF-W5R102M
C71	130104	CAP	CERAM	1000 PFD	100 V	20%	72982	9ACF-W5R102M
C72	130104	CAP	CERAM	1000 PFD	100 V	20%	72982	9ACF-W5R102M
C73	130104	CAP	CERAM	1000 PFD	100 V	20%	72982	9ACF-W5R102M
C74	110140	CAP	TANTA	47 MFD	6 V	20%	05397	T368B476M006AS
C75	130104	CAP	CERAM	1000 PFD	100 V	20%	72982	9ACF-W5R102M
C76	130104	CAP	CERAM	1000 PFD	100 V	20%	72982	9ACF-W5R102M
C77	110151	CAP	TANTA	10 MFD	35 V	20%	05397	T362C106M035A
C78	130104	CAP	CERAM	1000 PFD	100 V	20%	72982	9ACF-W5R102M
C79	100071	CAP	CERAM	.001 MFD	1 KV	20%	56289	C023B102E102M
C80	130104	CAP	CERAM	1000 PFD	100 V	20%	72982	9ACF-W5R102M

406723 – Assy., PCB, MAIN LOGIC *continued*

REF DES	DANA P/N	DESCRIPTION					FSC	MANU P/N
C81	130104	CAP	CERAM	1000 PFD	100 V	20%	72982	9ACF-W5R102M
C82	130104	CAP	CERAM	1000 PFD	100 V	20%	72982	9ACF-W5R102M
C83	130104	CAP	CERAM	1000 PFD	100 V	20%	72982	9ACF-W5R102M
C84	130104	CAP	CERAM	1000 PFD	100 V	20%	72982	9ACF-W5R102M
C85	130104	CAP	CERAM	1000 PFD	100 V	20%	72982	9ACF-W5R102M
C86	100071	CAP	CERAM	.001 MFD	1 KV	20%	56289	C023B102E102M
C87	100025	CAP	CERAM	.005 MFD	100 V	20%	72982	835-000-X5V0502Z
C88	110151	CAP	TANTA	10 MFD	35 V	20%	05397	T362C106M035A
C89	130104	CAP	CERAM	1000 PFD	100 V	20%	72982	9ACF-W5R102M
C90	130104	CAP	CERAM	1000 PFD	100 V	20%	72982	9ACF-W5R102M
C91	100017	CAP	CERAM	.01 MFD	100 V	20%	56289	C023B101F103M
C92	130103	CAP	CERAM	.01 MFD	25 V	20%	72982	9ACF-W5R103M
C93	130103	CAP	CERAM	.01 MFD	25 V	20%	72982	9ACF-W5R103M
C94	130103	CAP	CERAM	.01 MFD	25 V	20%	72982	9ACF-W5R103M
C95	110151	CAP	TANTA	10 MFD	35 V	20%	05397	T362C106M035A
C96	110151	CAP	TANTA	10 MFD	35 V	20%	05397	T362C106M035A
C97	130104	CAP	CERAM	1000 PFD	100 V	20%	72982	9ACF-W5R102M
C98	130104	CAP	CERAM	1000 PFD	100 V	20%	72982	9ACF-W5R102M
C99	110151	CAP	TANTA	10 MFD	35 V	20%	05397	T362C106M035A
C100	130104	CAP	CERAM	1000 PFD	100 V	20%	72982	9ACF-W5R102M
C101	110151	CAP	TANTA	10 MFD	35 V	20%	05397	T362C106M035A
C102	130104	CAP	CERAM	1000 PFD	100 V	20%	72982	9ACF-W5R102M
C103	130104	CAP	CERAM	1000 PFD	100 V	20%	72982	9ACF-W5R102M
C104	130104	CAP	CERAM	1000 PFD	100 V	20%	72982	9ACF-W5R102M
C105	130104	CAP	CERAM	1000 PFD	100 V	20%	72982	9ACF-W5R102M
C106	110151	CAP	TANTA	10 MFD	35 V	20%	05397	T362C106M035A
C107	130104	CAP	CERAM	1000 PFD	100 V	20%	72982	9ACF-W5R102M
C108	110151	CAP	TANTA	10 MFD	35 V	20%	05397	T362C106M035A
C109	130104	CAP	CERAM	1000 PFD	100 V	20%	72982	9ACF-W5R102M
C110	130104	CAP	CERAM	1000 PFD	100 V	20%	72982	9ACF-W5R102M
C111	130104	CAP	CERAM	1000 PFD	100 V	20%	72982	9ACF-W5R102M
C112	130104	CAP	CERAM	1000 PFD	100 V	20%	72982	9ACF-W5R102M
C113	130103	CAP	CERAM	.01 MFD	25 V	20%	72982	9ACF-W5R103M
C114	130104	CAP	CERAM	1000 PFD	100 V	20%	72982	9ACF-W5R102M
C115	110140	CAP	TANTA	47 MFD	6 V	20%	05397	T368B476M006AS
C116	130104	CAP	CERAM	1000 PFD	100 V	20%	72982	9ACF-W5R102M
CR1	220031	DIODE	SILICO	ZENER	3.3 V		04713	1/4M3.3AZ5
CR5	211083	DIODE	SILICO		018		21793	211083
CR6	211236	DIODE	SILICO		007		21793	211236

406723 – Assy., PCB, MAIN LOGIC *continued*

REF DES	DANA P/N	DESCRIPTION	FSC	MANU P/N
CR7	211083	DIODE SILICO 018	21793	211083
CR8	211083	DIODE SILICO 018	21793	211083
CR9	211083	DIODE SILICO 018	21793	211083
CR10	210022	DIODE	50434	HP5082-3080
CR11	210022	DIODE	50434	HP5082-3080
CR12	210022	DIODE	50434	HP5082-3080
CR13	210022	DIODE	50434	HP5082-3080
CR14	210004	DIODE SILICO	81349	1N4004
CR15	210022	DIODE	50434	HP5082-3080
CR16	211083	DIODE SILICO 018	21793	211083
CR17	211083	DIODE SILICO 018	21793	211083
CR18	210026	DIODE RF DET	81349	1N82AG
CR19	210026	DIODE RF DET	81349	1N82AG
CR20	211083	DIODE SILICO 018	21793	211083
H1	453810	INSULATOR, SWITCH (1*)	21793	453810
H3	600744	CONN PC JACK (14*)	71279	450-3750-1-03
H4	615044	SCREW, PPH, 4-40 x 3/8 (4*)		
H5	615048	SCREW, PPH, 4-40 x 3/4 (4*)		
H6	617004	NUT, HEX, 4-40 (8*)		
H7	617102	WASHER, FLAT, #4 (8*)		
H8	617127	WASHER, SPLIT LOCK, #4 (8*)		
H9	730626	COVER, ATTENUATOR (1*)	21793	730626
H10	920006	TRANSISTOR PAD (Q26 – 27) (2*)	07047	10001-DAP
H11	920007	TRANSISTOR PAD (Q2, Q4, Q6, Q8-9) (5*)	07047	10045-DAP
H12	920419	INTEGRATED CIRCUIT SOCKET, 16 PIN (MC1-3, ME8, MF9) (5*)	52072	CA-16CS-TSD-E
H13	920460	INTEGRATED CIRCUIT SOCKET, 14 PIN (MA2-3, 5, MB5, MC5, MD1-3, ME1-3, 9, 10, MF1-3, 5-8) (20*)	52072	C4-14CS-TSD-E
H14	920482	INTEGRATED CIRCUIT SOCKET, 8 PIN (MB9) (1*)	71785	133-98-92-061
H15	920624	INTEGRATED CIRCUIT SOCKET, 24 PIN (MF4) (1*)	71785	133-59-02-063
H16	920279	PAD (Y1) (1*)	75835	10274
J1	600723	CONN, DUAL 16 PIN	21793	600723
J4	600726	CONN, WAFER 12 PIN	27264	2402-12A
L1	310101	CHOKE, RF .27 µH 10%	99800	1025-06
L2	310101	CHOKE, RF .27 µH 10%	99800	1025-06
L3	310101	CHOKE, RF .27 µH 10%	99800	1025-06

*Quantity Required

406723 – Assy., PCB, MAIN LOGIC *continued*

REF DES	DANA P/N	DESCRIPTION	FSC	MANU P/N
L4	310062	INDUCTOR 22 µH	99800	1537-44
L5	310062	INDUCTOR 22 µH	99800	1537-44
L6	310062	INDUCTOR 22 µH	99800	1537-44
L7	310062	INDUCTOR 22 µH	99800	1537-44
L8	310062	INDUCTOR 22 µH	99800	1537-44
L9	310062	INDUCTOR 22 µH	99800	1537-44
L10	310062	INDUCTOR 22 µH	99800	1537-44
L11	310062	INDUCTOR 22 µH	99800	1537-44
A1	230182	INTEGRATED CIRCUIT AMPLIFIER	25403	ATF417
A2	230183	INTEGRATED CIRCUIT AMPLIFIER	25403	ATF419
MA2	230028	INTEGRATED CIRCUIT	01295	7400
MA3	230064	INTEGRATED CIRCUIT	01295	7404
MA5	230032	INTEGRATED CIRCUIT	01295	7420
MA7	230175	INTEGRATED CIRCUIT	86884	3049
MB5	230028	INTEGRATED CIRCUIT	01295	7400
MB9	230119	INTEGRATED CIRCUIT µA741	07263	741HC
MC1	230065	INTEGRATED CIRCUIT	01295	7475
MC2	230065	INTEGRATED CIRCUIT	01295	7475
MC3	230065	INTEGRATED CIRCUIT	01295	7475
MC5	230064	INTEGRATED CIRCUIT	01295	7404
MD1	230037	INTEGRATED CIRCUIT	01295	7490
MD2	230037	INTEGRATED CIRCUIT	01295	7490
MD3	230064	INTEGRATED CIRCUIT	01295	7404
MD6	230112	INTEGRATED CIRCUIT	04713	MC10131
MD7	230170	INTEGRATED CIRCUIT	04713	MC1664L
MD9	230184	INTEGRATED CIRCUIT		SP616B
ME1	230064	INTEGRATED CIRCUIT	01295	7404
ME2	230064	INTEGRATED CIRCUIT	01295	7404
ME3	230031	INTEGRATED CIRCUIT	01295	7410
ME6	230112	INTEGRATED CIRCUIT	04713	MC10131
ME7	230095	INTEGRATED CIRCUIT	04713	MC1670L
ME8	230112	INTEGRATED CIRCUIT	04713	MC10131
ME9	230028	INTEGRATED CIRCUIT	01295	7400
ME10	230072	INTEGRATED CIRCUIT	01295	7474
MF1	230028	INTEGRATED CIRCUIT	01295	7400
MF2	230028	INTEGRATED CIRCUIT	01295	7400
MF3	230031	INTEGRATED CIRCUIT	01295	7410
MF4	230174	INTEGRATED CIRCUIT	07263	3815
MF5	230028	INTEGRATED CIRCUIT	01295	7400
MF6	230072	INTEGRATED CIRCUIT	01295	7474

406723 – Assy., PCB, MAIN LOGIC *continued*

REF DES	DANA P/N	DESCRIPTION					FSC	MANU P/N
MF7	230064	INTEGRATED CIRCUIT					01295	7404
MF8	230028	INTEGRATED CIRCUIT					01295	7400
MF9	230173	INTEGRATED CIRCUIT					50088	MK5009P
Q1	200088	TRANS	SILICO	PNP			80131	2N4248
Q2	200211	TRANS	FET	DUAL			86884	40673
Q3	200088	TRANS	SILICO	PNP			80131	2N4248
Q4	200186	TRANS		MATCHED PAIR			21793	200186
Q5	200088	TRANS	SILICO	PNP			80131	2N4248
Q6	200151	TRANS	SILICO				81349	2N5179
Q7	200088	TRANS	SILICO	PNP			80131	2N4248
Q8	200151	TRANS	SILICO				81349	2N5179
Q9	200186	TRANS		MATCHED PAIR			21793	200186
Q10	200099	TRANS		PNP			81349	2N4258
Q11	200099	TRANS		PNP			81349	2N4258
Q13	200095	TRANS		NPN			81349	2N3563
Q14	200095	TRANS		NPN			81349	2N3563
Q15	200095	TRANS		NPN			81349	2N3563
Q16	200095	TRANS		NPN			81349	2N3563
Q17	200095	TRANS		NPN			81349	2N3563
Q18	200095	TRANS		NPN			81349	2N3563
Q19	200088	TRANS	SILICO	PNP			80131	2N4248
Q21	200037	TRANS	SILICO	NPN			80131	2N3646
Q22	200088	TRANS	SILICO	PNP			80131	2N4248
Q23	200037	TRANS	SILICO	NPN			80131	2N3646
Q24	200088	TRANS	SILICO	PNP			80131	2N4248
Q25	200037	TRANS	SILICO	NPN			80131	2N3646
Q26	200035	TRANS	SILICO	NPN	014		21793	200035
Q27	200011	TRANS	SILICO	PNP	009		21793	200011
Q28	200200	TRANS		NPN			21793	200200
Q29	200200	TRANS		NPN			21793	200200
Q30	200068	TRANS		PNP			80131	2N4250
Q31	200068	TRANS		PNP			80131	2N4250
Q32	200037	TRANS	SILICO	NPN			80131	2N3646
Q33	200037	TRANS	SILICO	NPN			80131	2N3646
R1	000821	RES	CARBON	820 OHM		5% 1/4W	81349	RC07GF821J
R2	000511	RES	CARBON	510 OHM		5% 1/4W	81349	RC07GF511J
R3	000472	RES	CARBON	4.7 K		5% 1/4W	81349	RC07GF472J
R4	000241	RES	CARBON	240 OHM		5% 1/4W	81349	RC07GF241J
R5	000241	RES	CARBON	240 OHM		5% 1/4W	81349	RC07GF241J
R6	000390	RES	CARBON	39 OHM		5% 1/4W	81349	RC07GF390J

406723 – Assy., PCB, MAIN LOGIC *continued*

REF DES	DANA P/N	DESCRIPTION				FSC	MANU P/N
R7	000200	RES	CARBON	20 OHM	5% 1/4W	81349	RC07GF200J
R8	000204	RES	CARBON	200 K	5% 1/4W	81349	RC07GF204J
R9	000205	RES	CARBON	2 M	5% 1/4W	81349	RC07GF205J
R10	000106	RES	CARBON	10 M	5% 1/4W	81349	RC07GF106J
R11	000305	RES	CARBON	3 M	5% 1/4W	81349	RC07GF305J
R12	000105	RES	CARBON	1 M	5% 1/4W	81349	RC07GF105J
R13	000241	RES	CARBON	240 OHM	5% 1/4W	81349	RC07GF241J
R14	000202	RES	CARBON	2 K	5% 1/4W	81349	RC07GF202J
R15	000305	RES	CARBON	3 M	5% 1/4W	81349	RC07GF305J
R16	000241	RES	CARBON	240 OHM	5% 1/4W	81349	RC07GF241J
R17	000203	RES	CARBON	20 K	5% 1/4W	81349	RC07GF203J
R18	000181	RES	CARBON	180 OHM	5% 1/4W	81349	RC07GF181J
R19	000361	RES	CARBON	360 OHM	5% 1/4W	81349	RC07GF361J
R20	000751	RES	CARBON	750 OHM	5% 1/4W	81349	RC07GF751J
R21	000101	RES	CARBON	100 OHM	5% 1/4W	81349	RC07GF101J
R23	000511	RES	CARBON	510 OHM	5% 1/4W	81349	RC07GF511J
R24	000511	RES	CARBON	510 OHM	5% 1/4W	81349	RC07GF511J
R25	000911	RES	CARBON	910 OHM	5% 1/4W	81349	RC07GF911J
R26	000181	RES	CARBON	180 OHM	5% 1/4W	81349	RC07GF181J
R27	000361	RES	CARBON	360 OHM	5% 1/4W	81349	RC07GF361J
R28	000511	RES	CARBON	510 OHM	5% 1/4W	81349	RC07GF511J
R29	000101	RES	CARBON	100 OHM	5% 1/4W	81349	RC07GF101J
R30	010628	RES	METAL	3.01 K	1% 1/10W	81349	RN55C3011F
R31	000152	RES	CARBON	1.5 K	5% 1/4W	81349	RC07GF152J
R32	000511	RES	CARBON	510 OHM	5% 1/4W	81349	RC07GF511J
R33	000511	RES	CARBON	510 OHM	5% 1/4W	81349	RC07GF511J
R34	000152	RES	CARBON	1.5 K	5% 1/4W	81349	RC07GF152J
R35	000511	RES	CARBON	510 OHM	5% 1/4W	81349	RC07GF511J
R36	000181	RES	CARBON	180 OHM	5% 1/4W	81349	RC07GF181J
R37	000241	RES	CARBON	240 OHM	5% 1/4W	81349	RC07GF241J
R38	000361	RES	CARBON	360 OHM	5% 1/4W	81349	RC07GF361J
R39	000121	RES	CARBON	120 OHM	5% 1/4W	81349	RC07GF121J
R40	000910	RES	CARBON	91 OHM	5% 1/4W	81349	RC07GF910J
R41	000470	RES	CARBON	47 OHM	5% 1/4W	81349	RC07GF470J
R42	000152	RES	CARBON	1.5 K	5% 1/4W	81349	RC07GF152J
R43	040086	POT	CERMET	2 K	10%	73138	62PR2K
R44	000511	RES	CARBON	510 OHM	5% 1/4W	81349	RC07GF511J
R45	000511	RES	CARBON	510 OHM	5% 1/4W	81349	RC07GF511J
R46	000121	RES	CARBON	120 OHM	5% 1/4W	81349	RC07GF121J
R47	000430	RES	CARBON	43 OHM	5% 1/4W	81349	RC07GF430J
R48	000910	RES	CARBON	91 OHM	5% 1/4W	81349	RC07GF910J
R49	000470	RES	CARBON	47 OHM	5% 1/4W	81349	RC07GF470J

406723 – Assy., PCB, MAIN LOGIC *continued*

REF DES	DANA P/N	DESCRIPTION				FSC	MANU P/N
R50	000152	RES	CARBON	1.5 K	5% 1/4W	81349	RC07GF152J
R51	000511	RES	CARBON	510 OHM	5% 1/4W	81349	RC07GF511J
R52	000102	RES	CARBON	1 K	5% 1/4W	81349	RC07GF102J
R53	000561	RES	CARBON	560 OHM	5% 1/4W	81349	RC07GF561J
R54	000181	RES	CARBON	180 OHM	5% 1/4W	81349	RC07GF181J
R55	000361	RES	CARBON	360 OHM	5% 1/4W	81349	RC07GF361J
R56	000511	RES	CARBON	510 OHM	5% 1/4W	81349	RC07GF511J
R57	000511	RES	CARBON	510 OHM	5% 1/4W	81349	RC07GF511J
R58	000511	RES	CARBON	510 OHM	5% 1/4W	81349	RC07GF511J
R59	000391	RES	CARBON	390 OHM	5% 1/4W	81349	RC07GF391J
R60	000121	RES	CARBON	120 OHM	5% 1/4W	81349	RC07GF121J
R61	000201	RES	CARBON	200 OHM	5% 1/4W	81349	RC07GF201J
R62	000821	RES	CARBON	820 OHM	5% 1/4W	81349	RC07GF821J
R63	010628	RES	METAL	3.01 K	1% 1/10W	81349	RN55C3011F
R64	000152	RES	CARBON	1.5 K	5% 1/4W	81349	RC07GF152J
R65	000202	RES	CARBON	2 K	5% 1/4W	81349	RC07GF202J
R66	000302	RES	CARBON	3 K	5% 1/4W	81349	RC07GF302J
R67	000510	RES	CARBON	51 OHM	5% 1/4W	81349	RC07GF510J
R68	000510	RES	CARBON	51 OHM	5% 1/4W	81349	RC07GF510J
R69	000510	RES	CARBON	51 OHM	5% 1/4W	81349	RC07GF510J
R70	001872	RES	CARBON	51 OHM	5% 1/8W	01121	See Descrpt.
R71	000470	RES	CARBON	47 OHM	5% 1/4W	81349	RC07GF470J
R72	000102	RES	CARBON	1 K	5% 1/4W	81349	RC07GF102J
R73	000751	RES	CARBON	750 OHM	5% 1/4W	81349	RC07GF751J
R74	000152	RES	CARBON	1.5 K	5% 1/4W	81349	RC07GF152J
R75	000512	RES	CARBON	5.1 K	5% 1/4W	81349	RC07GF512J
R76	000512	RES	CARBON	5.1 K	5% 1/4W	81349	RC07GF512J
R77	000512	RES	CARBON	5.1 K	5% 1/4W	81349	RC07GF512J
R78	000471	RES	CARBON	470 OHM	5% 1/4W	81349	RC07GF471J
R79	000201	RES	CARBON	200 OHM	5% 1/4W	81349	RC07GF201J
R80	000512	RES	CARBON	5.1 K	5% 1/4W	81349	RC07GF512J
R81	000201	RES	CARBON	200 OHM	5% 1/4W	81349	RC07GF201J
R82	000201	RES	CARBON	200 OHM	5% 1/4W	81349	RC07GF201J
R83	000302	RES	CARBON	3 K	5% 1/4W	81349	RC07GF302J
R84	000511	RES	CARBON	510 OHM	5% 1/4W	81349	RC07GF511J
R85	000201	RES	CARBON	200 OHM	5% 1/4W	81349	RC07GF201J
R86	000242	RES	CARBON	2.4 K	5% 1/4W	81349	RC07GF242J
R87	000101	RES	CARBON	100 OHM	5% 1/4W	81349	RC07GF101J
R88	000751	RES	CARBON	750 OHM	5% 1/4W	81349	RC07GF751J
R89	000152	RES	CARBON	1.5 K	5% 1/4W	81349	RC07GF152J
R90	000201	RES	CARBON	200 OHM	5% 1/4W	81349	RC07GF201J
R91	000186	RES	CARBON	18 M	5% 1/4W	81349	RC07GF186J

406723 – Assy., PCB, MAIN LOGIC *continued*

REF DES	DANA P/N	DESCRIPTION				FSC	MANU P/N
R92	000126	RES	CARBON	12 M	5% 1/4W	81349	RC07GF126J
R94	000750	RES	CARBON	75 OHM	5% 1/4W	81349	RC07GF750J
R95	000123	RES	CARBON	12 K	5% 1/4W	81349	RC07GF123J
R96	000821	RES	CARBON	820 OHM	5% 1/4W	81349	RC07GF821J
R97	000472	RES	CARBON	4.7 K	5% 1/4W	81349	RC07GF472J
R98	000152	RES	CARBON	1.5 K	5% 1/4W	81349	RC07GF152J
R99	000511	RES	CARBON	510 OHM	5% 1/4W	81349	RC07GF511J
R100	000200	RES	CARBON	20 OHM	5% 1/4W	81349	RC07GF200J
R101	000912	RES	CARBON	9.1 K	5% 1/4W	81349	RC07GF912J
R102	000512	RES	CARBON	5.1 K	5% 1/4W	81349	RC07GF512J
R103	000471	RES	CARBON	470 OHM	5% 1/4W	81349	RC07GF471J
R104	000511	RES	CARBON	510 OHM	5% 1/4W	81349	RC07GF511J
R105	000511	RES	CARBON	510 OHM	5% 1/4W	81349	RC07GF511J
R106	000511	RES	CARBON	510 OHM	5% 1/4W	81349	RC07GF511J
R107	000511	RES	CARBON	510 OHM	5% 1/4W	81349	RC07GF511J
R108	000101	RES	CARBON	100 OHM	5% 1/4W	81349	RC07GF101J
R109	000511	RES	CARBON	510 OHM	5% 1/4W	81349	RC07GF511J
R110	000472	RES	CARBON	4.7 K	5% 1/4W	81349	RC07GF472J
R111	000201	RES	CARBON	200 OHM	5% 1/4W	81349	RC07GF201J
R112	000302	RES	CARBON	3 K	5% 1/4W	81349	RC07GF302J
R113	000302	RES	CARBON	3 K	5% 1/4W	81349	RC07GF302J
R114	000302	RES	CARBON	3 K	5% 1/4W	81349	RC07GF302J
R115	000302	RES	CARBON	3 K	5% 1/4W	81349	RC07GF302J
R116	000821	RES	CARBON	820 OHM	5% 1/4W	81349	RC07GF821J
R117	000302	RES	CARBON	3 K	5% 1/4W	81349	RC07GF302J
R118	000302	RES	CARBON	3 K	5% 1/4W	81349	RC07GF302J
R119	000471	RES	CARBON	470 OHM	5% 1/4W	81349	RC07GF471J
R120	000302	RES	CARBON	3 K	5% 1/4W	81349	RC07GF302J
R121	000302	RES	CARBON	3 K	5% 1/4W	81349	RC07GF302J
R122	000102	RES	CARBON	1 K	5% 1/4W	81349	RC07GF102J
R123	000302	RES	CARBON	3 K	5% 1/4W	81349	RC07GF302J
R124	000302	RES	CARBON	3 K	5% 1/4W	81349	RC07GF302J
R125	000471	RES	CARBON	470 OHM	5% 1/4W	81349	RC07GF471J
R126	000101	RES	CARBON	100 OHM	5% 1/4W	81349	RC07GF101J
R127	000104	RES	CARBON	100 K	5% 1/4W	81349	RC07GF104J
R128	000302	RES	CARBON	3 K	5% 1/4W	81349	RC07GF302J
R129	000202	RES	CARBON	2 K	5% 1/4W	81349	RC07GF202J
R130	000302	RES	CARBON	3 K	5% 1/4W	81349	RC07GF302J
R131	000511	RES	CARBON	510 OHM	5% 1/4W	81349	RC07GF511J
R132	000181	RES	CARBON	180 OHM	5% 1/4W	81349	RC07GF181J
R133	001872	RES	CARBON	51 OHM	5% 1/8W	01121	See Descrpt.
R134	000510	RES	CARBON	51 OHM	5% 1/4W	81349	RC07GF510J

406723 – Assy., PCB, MAIN LOGIC *continued*

REF DES	DANA P/N	DESCRIPTION				FSC	MANU P/N
R135	000471	RES	CARBON	470 OHM	5% 1/4W	81349	RC07GF471J
R136	000511	RES	CARBON	510 OHM	5% 1/4W	81349	RC07GF511J
R137	000202	RES	CARBON	2 K	5% 1/4W	81349	RC07GF202J
R138	000102	RES	CARBON	1 K	5% 1/4W	81349	RC07GF102J
R139	000102	RES	CARBON	1 K	5% 1/4W	81349	RC07GF102J
R140	000102	RES	CARBON	1 K	5% 1/4W	81349	RC07GF102J
R141	000102	RES	CARBON	1 K	5% 1/4W	81349	RC07GF102J
R142	000102	RES	CARBON	1 K	5% 1/4W	81349	RC07GF102J
R143	000510	RES	CARBON	51 OHM	5% 1/4W	81349	RC07GF510J
R144	001683	RES	CARBON	47 OHM	5% 1/2W	81349	RC20GF470J
R145	000121	RES	CARBON	120 OHM	5% 1/4W	81349	RC07GF121J
R147	000510	RES	CARBON	51 OHM	5% 1/4W	81349	RC07GF510J
R148	001812	RES	CARBON	270 OHM	5% 1/2W	01121	See Descrpt.
R149	000510	RES	CARBON	51 OHM	5% 1/4W	81349	RC07GF510J
R150	000510	RES	CARBON	51 OHM	5% 1/4W	81349	RC07GF510J
R151	000100	RES	CARBON	10 OHM	5% 1/4W	81349	RC07GF100J
R152	000100	RES	CARBON	10 OHM	5% 1/4W	81349	RC07GF100J
R153	000510	RES	CARBON	51 OHM	5% 1/4W	81349	RC07GF510J
R154	000510	RES	CARBON	51 OHM	5% 1/4W	81349	RC07GF510J
R155	000512	RES	CARBON	5.1 K	5% 1/4W	81349	RC07GF512J
R156	000101	RES	CARBON	100 OHM	5% 1/4W	81349	RC07GF101J
R157	000432	RES	CARBON	4.3 K	5% 1/4W	81349	RC07GF432J
R158	040086	POT	CERMET	2 K	10%	73138	62PR2K
R159	000102	RES	CARBON	1 K	5% 1/4W	81349	RC07GF102J
R160	000123	RES	CARBON	12 K	5% 1/4W	81349	RC07GF123J
R161	000221	RES	CARBON	220 OHM	5% 1/4W	81349	RC07GF221J
R162	000100	RES	CARBON	10 OHM	5% 1/4W	81349	RC07GF100J
R163	000100	RES	CARBON	10 OHM	5% 1/4W	81349	RC07GF100J
R164	000100	RES	CARBON	10 OHM	5% 1/4W	81349	RC07GF100J
R165	000512	RES	CARBON	5.1 K	5% 1/4W	81349	RC07GF512J
R166	000104	RES	CARBON	100 K	5% 1/4W	81349	RC07GF104J
R167	000153	RES	CARBON	15 K	5% 1/4W	81349	RC07GF153J
R168	000302	RES	CARBON	3 K	5% 1/4W	81349	RC07GF302J
R169	000152	RES	CARBON	1.5 K	5% 1/4W	81349	RC07GF152J
R170	000222	RES	CARBON	2.2 K	5% 1/4W	81349	RC07GF222J
R171	000750	RES	CARBON	75 OHM	5% 1/4W	81349	RC07GF750J
R172	000100	RES	CARBON	10 OHM	5% 1/4W	81349	RC07GF100J
R173	000123	RES	CARBON	12 K	5% 1/4W	81349	RC07GF123J
R174	001683	RES	CARBON	47 OHM	5% 1/2W	81349	RC20GF470J
R175	000391	RES	CARBON	390 OHM	5% 1/4W	81349	RC07GF391J
R176	000681	RES	CARBON	680 OHM	5% 1/4W	81349	RC07GF681J
R177	000361	RES	CARBON	360 OHM	5% 1/4W	81349	RC07GF361J

406723 – Assy., PCB, MAIN LOGIC *continued*

REF DES	DANA P/N	DESCRIPTION	FSC	MANU P/N
R178	000300	RES CARBON 30 OHM 5% 1/4W	81349	RC07GF300J
R179	000102	RES CARBON 1 K 5% 1/4W	81349	RC07GF102J
R180	000102	RES CARBON 1 K 5% 1/4W	81349	RC07GF102J
R181	000302	RES CARBON 3 K 5% 1/4W	81349	RC07GF302J
R182	000302	RES CARBON 3 K 5% 1/4W	81349	RC07GF302J
R183	000132	RES CARBON 1.3 K 5% 1/4W	81349	RC07GF132J
R184	000152	RES CARBON 1.5 K 5% 1/4W	81349	RC07GF152J
R185	000100	RES CARBON 10 OHM 5% 1/4W	81349	RC07GF100J
R186	000100	RES CARBON 10 OHM 5% 1/4W	81349	RC07GF100J
R187	000100	RES CARBON 10 OHM 5% 1/4W	81349	RC07GF100J
R188	000100	RES CARBON 10 OHM 5% 1/4W	81349	RC07GF100J
S1	600721	SWITCH PUSHBUTTON	98978	
TP1	600591	POST, TEST POINT	00779	85931-6
TP2	600591	POST, TEST POINT	00779	85931-6
TP3	600591	POST, TEST POINT	00779	85931-6
W1	600245	JUMPER		L-2007-1LP
W2	600245	JUMPER		L-2007-1LP
Y1*	920696	CRYSTAL 1 MHz 32 PFD	11237	H-17W

*USED ON EARLY MODELS –
REPLACED WITH OSC-1 (PAGE 7-25)

406775 – Assy., POWER SUPPLY MODULE

REF DES	DANA P/N	DESCRIPTION	FSC	MANU P/N
A1	406762	ASSY., PCB, POWER SUPPLY	21793	406762
C4	110125	CAP TANTA 2.2 MFD 35 V 20%	05397	T368B225M035AS
C9	110143	CAP TANTA 1 MFD 35 V 20%	05397	T368A105M035AS
C13	110143	CAP TANTA 1 MFD 35 V 20%	05397	T368A105M035AS
C14	100111	CAP CERAM .01 MFD 2000 V	71471	HVD6-2KV
C15	100111	CAP CERAM .01 MFD 2000 V	71471	HVD6-2KV
F1	920204	FUSE SLO BLO 1/2 AMP 250 V	75915	3AG1/2ASB
F1**	920756	FUSE SLO BLO 1/4 AMP 250 V	75915	MDL1/4
H1	600022	SOLDER LUG (1*)	83330	1416-6
H2	610135	STANDOFF, THREADED, SWG., 6-32, .250DX. 188LG (4*)	88245	B1530-C-3/16-11
H3	610180	CABLE CLAMP (1*)	09922	HP3N-7/32
H4	610213	PRESS-NUT, 4-40 (1*)	46384	S-440-3
H5	610395	PRESS-NUT, 6-32 (1*)	46384	S-632-3
H6	610410	CABLE CLAMP (1*)	58730	TY-33M
H7	610507	PRESS-NUT, 8-32 (4*)	46384	S-832-3
H8	615043	SCREW, PPH, 4-40 x 5/16" LG (1*)		
H9	615079	SCREW, PPH, 8-32 x 7/8" LG (4*)		
H10	615058	SCREW, PPH, 6-32 x 5/16" LG (4*)		
H11	617104	WASHER, FLAT #8 (4*)		
H12	617079	WASHER, INT. LOCK, #6 (4*)		
H13	730657	BASE-PLATE (1*)	21793	730657
H14	730658	HEATSINK PLATE-TRANSFORMER (1*)	21793	730658
H15	730659	HEATSINK, TO3 Type MOD. (2*)	21793	730659
H16	730661	LABEL, VOLTAGE &FUSE (1*)	21793	730661
H17	920768	MOUNTING KIT, TRANS. (2*)	04713	MK15
H18	617080	WASHER, INT LK, #8 (4*)		
J1	600795	CONN	95238	6J1
T1	730654	TRANSFORMER, POWER	21793	730654
U1	230144	INTEGRATED CIRCUIT	27014	LM309KC
U2	230144	INTEGRATED CIRCUIT	27014	LM309KC
U3	230200	INTEGRATED CIRCUIT	04713	MC7812-CP
U4	230201	INTEGRATED CIRCUIT	04713	MC7912-CP
W1	600245	JUMPER, INSULATED		L-2007-1LP
W2	600245	JUMPER, INSULATED		L-2007-1LP

*Quantity Required

**Used in 230V Units

406762 – Assy., PCB, POWER SUPPLY

REF DES	DANA P/N	DESCRIPTION					FSC	MANU P/N
C1	110174	CAP	ELECT	10,000 MFD	15 V			39CS10HS14
C2	110157	CAP	ELECT	470 MFD	25 V		34553	ET471X025A01
C3	110157	CAP	ELECT	470 MFD	25 V		34553	ET471X025A01
C5	110125	CAP	TANTA	2.2 MFD	35 V	20%	05397	T368B225M035AS
C6	110125	CAP	TANTA	2.2 MFD	35 V	20%	05397	T368B225M035AS
C7	110125	CAP	TANTA	2.2 MFD	35 V	20%	05397	T368B225M035AS
C8	100057	CAP	CERAM	.1 MFD	500 V	20%	56289	5GA-P10
C9	100057	CAP	CERAM	.1 MFD	500 V	20%	56289	5GA-P10
C11	110143	CAP	TANTA	1 MFD	35 V	20%	05397	T368A105M035AS
C12	110143	CAP	TANTA	1 MFD	35 V	20%	05397	T368A105M035AS
CR1	210070	DIODE	POWER	3 AMP			04713	MR501
CR2	210070	DIODE	POWER	3 AMP			04713	MR501
CR3	210004	DIODE	SILICO				81349	1N4004
CR4	210004	DIODE	SILICO				81349	1N4004
CR5	210004	DIODE	SILICO				81349	1N4004
CR6	210004	DIODE	SILICO				81349	1N4004
CR7	210004	DIODE	SILICO				81349	1N4004
CR8	210004	DIODE	SILICO				81349	1N4004
CR9	210004	DIODE	SILICO				81349	1N4004
H1	600724	KEYS, CONN (1*)					27264	2560-2
H2	600727	TERMINAL (11*)					27264	2578-TL
H3	610487	STRAP, RUBBER					98159	2829-75-3
P4	600725	CONN, WAFER 12 PIN					27264	2139-12-2
R1	001880	RES	CARBON	3.6 OHM		5% 1/4W	81349	RC07GF3R6J
R2	040243	POT	CERMET	10 OHM		20% .5 W	73138	72PX10
R3	000301	RES	CARBON	300 OHM		5% 1/4W	81349	RC07GF301J
W1	600245	JUMPER, INSULATED						L-2007-1LP

*Quantity Required

406697 – Assy., PCB, DISPLAY

REF DES	DANA P/N	DESCRIPTION	FSC	MANU P/N
C1	110127	CAP TANTA 22 MFD 6 V 20%	05397	T368B226M006AS
CR1	210045	DIODE LED OVERLOAD	50579	RL-21
CR2	210045	DIODE LED OVERLOAD	50579	RL-21
H1	730639	LIGHT, REFLECTOR (2*)	21793	730639
LED 1	210060	DIODE LED DISPLAY	50434	HP5082-7730
LED 2	210060	DIODE LED DISPLAY	50434	HP5082-7730
LED 3	210060	DIODE LED DISPLAY	50434	HP5082-7730
LED 4	210060	DIODE LED DISPLAY	50434	HP5082-7730
LED 5	210060	DIODE LED DISPLAY	50434	HP5082-7730
LED 6	210060	DIODE LED DISPLAY	50434	HP5082-7730
LED 7	210060	DIODE LED DISPLAY	50434	HP5082-7730
M1	230132	INTEGRATED CIRCUIT	07263	7447
M2	230132	INTEGRATED CIRCUIT	07263	7447
M3	230132	INTEGRATED CIRCUIT	07263	7447
M4	230132	INTEGRATED CIRCUIT	07263	7447
Q2	200037	TRANS SILICO NPN	80131	2N3646
Q3	200184	TRANS PNP	04713	MPS A55
Q4	200184	TRANS PNP	04713	MPS A55
Q5	200184	TRANS PNP	04713	MPS A55
Q6	200184	TRANS PNP	04713	MPS A55
Q7	200184	TRANS PNP	04713	MPS A55
R1	000471	RES CARBON 470 OHM 5% 1/4W	81349	RC07GF471J
R2	000471	RES CARBON 470 OHM 5% 1/4W	81349	RC07GF471J
R3	000471	RES CARBON 470 OHM 5% 1/4W	81349	RC07GF471J
R4	000471	RES CARBON 470 OHM 5% 1/4W	81349	RC07GF471J
R5	000471	RES CARBON 470 OHM 5% 1/4W	81349	RC07GF471J
R6	000471	RES CARBON 470 OHM 5% 1/4W	81349	RC07GF471J
R7	000471	RES CARBON 470 OHM 5% 1/4W	81349	RC07GF471J
R8	000471	RES CARBON 470 OHM 5% 1/4W	81349	RC07GF471J
R9	000471	RES CARBON 470 OHM 5% 1/4W	81349	RC07GF471J
R10	000471	RES CARBON 470 OHM 5% 1/4W	81349	RC07GF471J
R11	000471	RES CARBON 470 OHM 5% 1/4W	81349	RC07GF471J
R12	000471	RES CARBON 470 OHM 5% 1/4W	81349	RC07GF471J
		*Quantity Required		

406697 – Assy., PCB, DISPLAY *continued*

REF DES	DANA P/N	DESCRIPTION	FSC	MANU P/N
R13	000471	RES CARBON 470 OHM 5% 1/4W	81349	RC07GF471J
R14	000471	RES CARBON 470 OHM 5% 1/4W	81349	RC07GF471J
R15	000471	RES CARBON 470 OHM 5% 1/4W	81349	RC07GF471J
R16	000471	RES CARBON 470 OHM 5% 1/4W	81349	RC07GF471J
R17	000471	RES CARBON 470 OHM 5% 1/4W	81349	RC07GF471J
R18	000471	RES CARBON 470 OHM 5% 1/4W	81349	RC07GF471J
R19	000471	RES CARBON 470 OHM 5% 1/4W	81349	RC07GF471J
R20	000471	RES CARBON 470 OHM 5% 1/4W	81349	RC07GF471J
R21	000471	RES CARBON 470 OHM 5% 1/4W	81349	RC07GF471J
R22	000101	RES CARBON 100 OHM 5% 1/4W	81349	RC07GF101J
R23	000101	RES CARBON 100 OHM 5% 1/4W	81349	RC07GF101J
R24	000101	RES CARBON 100 OHM 5% 1/4W	81349	RC07GF101J
R25	000101	RES CARBON 100 OHM 5% 1/4W	81349	RC07GF101J
R26	000101	RES CARBON 100 OHM 5% 1/4W	81349	RC07GF101J
R27	000101	RES CARBON 100 OHM 5% 1/4W	81349	RC07GF101J
R28	000101	RES CARBON 100 OHM 5% 1/4W	81349	RC07GF101J
R29	000101	RES CARBON 100 OHM 5% 1/4W	81349	RC07GF101J
R30	000471	RES CARBON 470 OHM 5% 1/4W	81349	RC07GF471J
R31	000102	RES CARBON 1 K 5% 1/4W	81349	RC07GF102J
R32	000200	RES CARBON 20 OHM 5% 1/4W	81349	RC07GF200J
R33	000102	RES CARBON 1 K 5% 1/4W	81349	RC07GF102J
R34	000121	RES CARBON 120 OHM 5% 1/4W	81349	RC07GF121J
R35	000121	RES CARBON 120 OHM 5% 1/4W	81349	RC07GF121J
R36	000102	RES CARBON 1 K 5% 1/4W	81349	RC07GF102J
R37	000102	RES CARBON 1 K 5% 1/4W	81349	RC07GF102J
R38	000102	RES CARBON 1 K 5% 1/4W	81349	RC07GF102J
W1	600245	JUMPER, INSULATED		L-2007-1LP

406714 – 8th DIGIT – OPTION 08

REF DES	DANA P/N	DESCRIPTION	FSC	MANU P/N
LED 8	210060	DIODE LED DISPLAY	50434	HP5082-7730
Q1	200037	TRANS SILICO NPN	80131	2N3646

406727 – TCXO – OPTION 21

REF DES	DANA P/N	DESCRIPTION	FSC	MANU P/N
C17	100017	CAP CERAM .01 MFD 100 V 20%	56289	C023B101F103M
H1	730624	INSULATOR, ELECTRICAL (1*)	21793	730624
H2	920460	SOCKET, 14 PIN (ME11) (1*)	52072	CA-14CS-TSD-E
ME11	230037	INTEGRATED CIRCUIT	07263	7490
OSC-1	730551	TCXO OSCILLATOR	21793	730551
		DELETE		
C19	130052	CAP CERAM 2-8 PFD	72982	538006A2-8
C20	100104	CAP CERAM 100 PFD 1 KV 5%	56289	C030A102L101J
Y1	920696	CRYSTAL 1 MHZ 32 PFD	11237	H-17W

406841 – TCXO – OPTION 22

REF DES	DANA P/N	DESCRIPTION	FSC	MANU P/N
C17	100017	CAP CERAM .01 MFD 100 V 20%	56289	C023B101F103M
H1	730624	INSULATOR, ELECTRICAL (1*)	21793	730624
H2	920460	SOCKET, 14 PIN (ME11) (1*)	52072	CA-14CS-TSD-E
ME11	230037	INTEGRATED CIRCUIT	07263	7490
OSC-1	730705	TCXO 10 MHz $11x10^{-7}$	21793	730705
		DELETE		
C18	100052	CAP CERAM 22 PFD 1 KV 5%	56289	C030B102F220J
C19	130052	CAP CERAM 2-8 PFD	72982	538006A2-8
C20	100104	CAP CERAM 100 PFD 1 KV 5%	56289	C030A102L101J
Y1	920696	CRYSTAL 1 MHZ 32 PFD	11237	H-17W

*Quantity Required

406726 – OVERDRIVE PROTECTION – OPTION 41

REF DES	DANA P/N	DESCRIPTION	FSC	MANU P/N
F1	920054	FUSE .1 AMP	71400	BMW1/10

406722 – Assy., BCD OUTPUT MODIFICATION KIT

REF DES	DANA P/N	DESCRIPTION	FSC	MANU P/N
A1	406712	Assy., PCB BCD OPTION	21793	406712
H1	610736	PIN-GUIDE (Male) (2*)	11769	62-8202-40-12
H2	615041	SCREW, 4-40 x 3/16 (3*)		
H3	615060	SCREW, 6-32 x 7/16 (2*)		
H4	617005	NUT, HEX STD. 6-32 (2*)		
P2	600732	TERMINAL CONTACT (2*)	11769	02-008-323-6-100
P3	600732	TERMINAL CONTACT (2*)	11769	02-008-323-6-100
P201	600733	CONN, EDGE, 50 PIN (1*)	05574	3VH25/1JN5

*Quantity Required

406712 – BCD OUTPUT

REF DES	DANA P/N	DESCRIPTION	FSC	MANU P/N
C1	100017	CAP CERAM .01 MFD 100 V 20%	56289	C023B101F103M
C2	100017	CAP CERAM .01 MFD 100 V 20%	56289	C023B101F103M
C3	101174	CAP CERAM .001 MFD 500 V 10%	04222	SCD-DI-2X5F-1000
C4	110140	CAP TANTA 47 MFD 6 V 20%	05397	T368B476M006AS
C5	100024	CAP CERAM .1 MFD 25 V	72982	5815-000Y5U104Z
C6	100017	CAP CERAM .01 MFD 100 V 20%	56289	C023B101F103M
C7	100017	CAP CERAM .01 MFD 100 V 20%	56289	C023B101F103M
C8	100024	CAP CERAM .1 MFD 25 V	72982	5815-000Y5U104Z
CR1	211083	DIODE SILICO 018	21793	211083
H1	610735	PIN-GUIDE SOCKET (Female) (2*)	11769	62-5304-40-12
H2	610695	STANDOFF, SWAGED, 4-40 x .250 (3*)	71279	1300-11
H3	920419	SOCKET, 16 PIN (ME1 – ME5) (5*)	52072	CA-16CS-TSD-E
H4	920460	SOCKET, 14 PIN (MB4-5, MC5, MD4-5) (5*)	52072	CA-14CS-TSD-E
P2	600732	TERMINAL CONTACT (2*)	11769	02-008-323-6-100
P3	600732	TERMINAL CONTACT (2*)	11769	02-008-323-6-100
MB4	230028	INTEGRATED CIRCUIT	01295	7400
MB5	230064	INTEGRATED CIRCUIT	01295	7404
MC5	230030	INTEGRATED CIRCUIT	01295	7402
MD4	230028	INTEGRATED CIRCUIT	01295	7400
MD5	230072	INTEGRATED CIRCUIT	01295	7474
ME1	230065	INTEGRATED CIRCUIT	01295	7475
ME2	230065	INTEGRATED CIRCUIT	01295	7475
ME3	230065	INTEGRATED CIRCUIT	01295	7475
ME4	230065	INTEGRATED CIRCUIT	01295	7475
ME5	230065	INTEGRATED CIRCUIT	01295	7475
Q1	200184	TRANS PNP	04713	MPS A55
R1	000101	RES CARBON 100 OHM 5% 1/4W	81349	RC07GF101J
R2	000302	RES CARBON 3 K 5% 1/4W	81349	RC07GF302J
R3	000302	RES CARBON 3 K 5% 1/4W	81349	RC07GF302J
R4	000302	RES CARBON 3 K 5% 1/4W	81349	RC07GF302J
R5	000302	RES CARBON 3 K 5% 1/4W	81349	RC07GF302J
R6	000241	RES CARBON 240 OHM 5% 1/4W	81349	RC07GF241J

*Quantity Required

406712 – BCD OUTPUT *continued*

REF DES	DANA P/N	DESCRIPTION				FSC	MANU P/N
R7	000512	RES	CARBON	5.1 K	5% 1/4W	81349	RC07GF512J
R8	000512	RES	CARBON	5.1 K	5% 1/4W	81349	RC07GF512J
R9	000302	RES	CARBON	3 K	5% 1/4W	81349	RC07GF302J

403927 – Assy., RACK MOUNT, 3-1/2"(Option 60)

REF DES	DANA P/N	DESCRIPTION	FSC	MANU P/N
H1	454019	MOUNTING EAR (2*)	21793	454019
H2	610395	NUT, PRESS, #6-32 (8*)	46384	S632-3
H3	615558	SCREW, PFH, 6-32 x 3/8, SS (8*)		
H4	617103	WASHER, FLAT, #6, SS (8*)		
H5	618010	SCREW, PRH 6-32 x 3/8, Self-Tapping, Type F (4*)		

403937 – Assy., RACK MOUNTING KIT, 5-1/4 HIGH (Option 62)

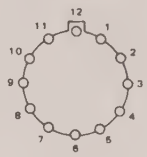
REF DES	DANA P/N	DESCRIPTION	FSC	MANU P/N
H1	610807	STUD, PRESS, 8-32x3/8, SS, CP (6*)	46384	FH-832-6
H2	617006	NUT, HEX, 8-32, STD, SS (6*)		
H3	617080	WASHER, INTERNAL TOOTH LOCK, #8, SS (6*)		
H4	730698	BRACKET, RACK MOUNTING (2*)	21793	730698
H5	730699	PANEL, FRONT (1*)	21793	730699
H6	730700	CLAMP, RACK MOUNTING BRACKET (2*)	21793	730700

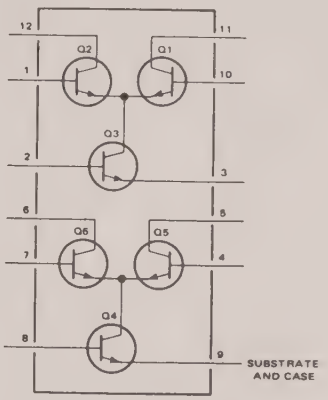
*Quantity Required

APPENDIX

This appendix contains drawings of integrated circuits used in this instrument. Each drawing contains a pin location guide and a simplified block diagram to indicate the basic function of the device. The drawings are provided as an aid for trouble-shooting.

CA3049





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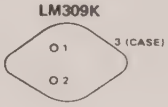

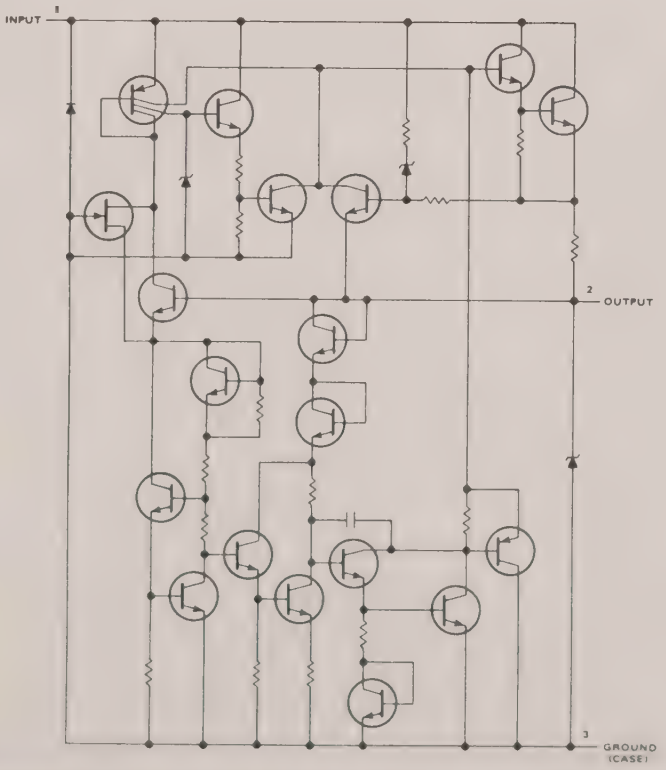

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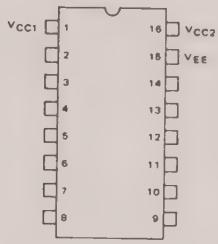

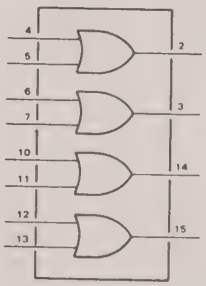

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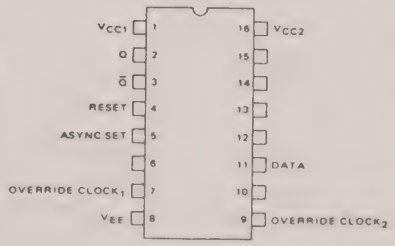

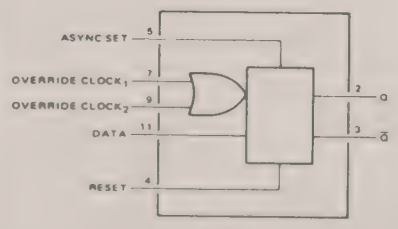

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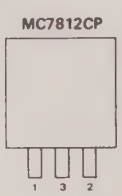

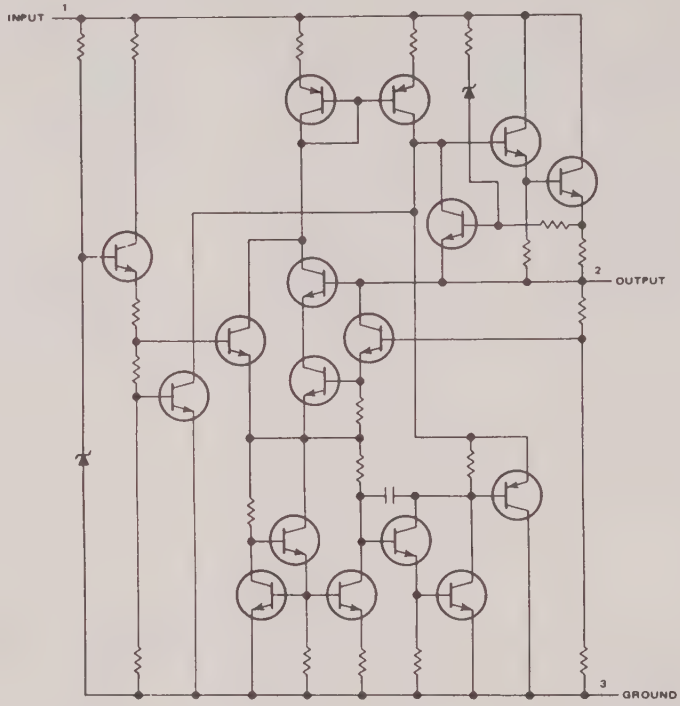

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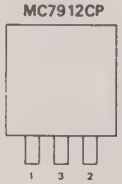

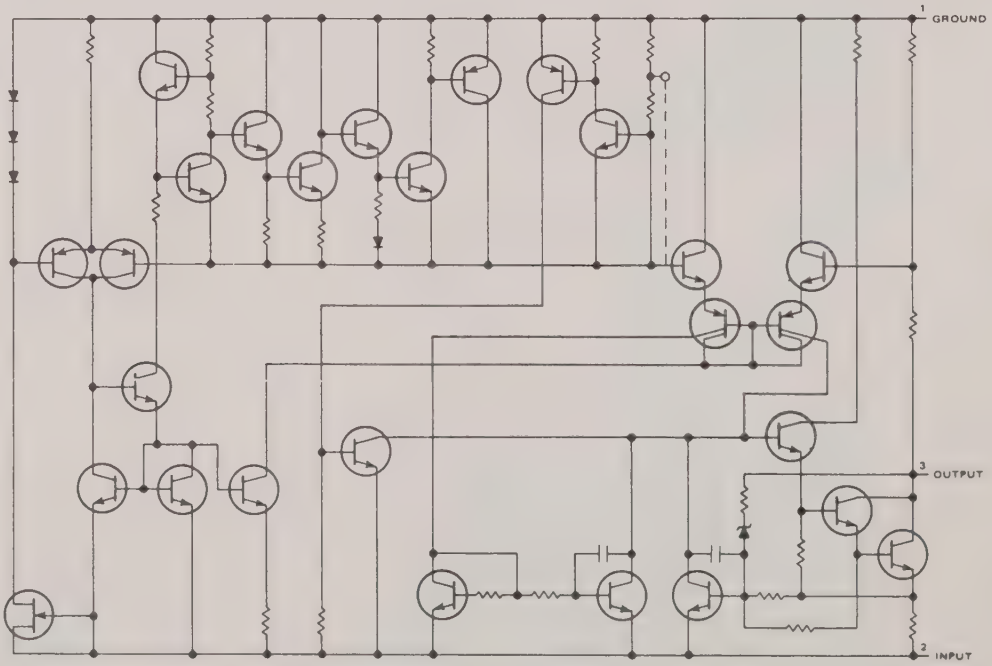

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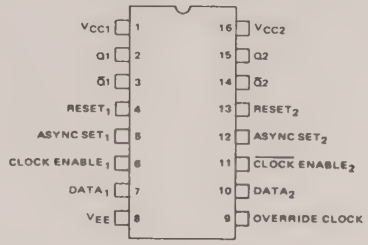

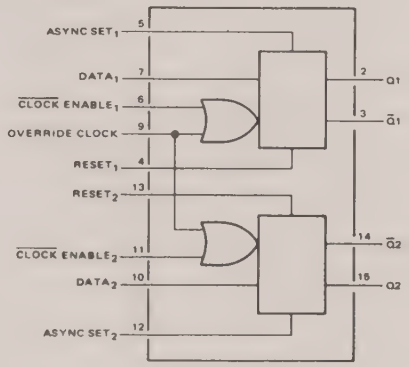

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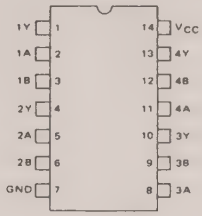

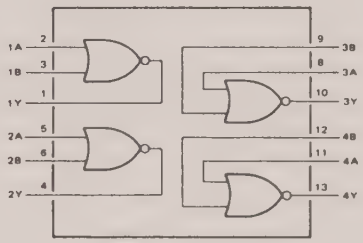

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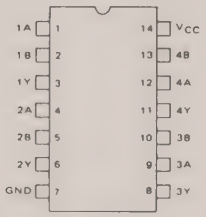

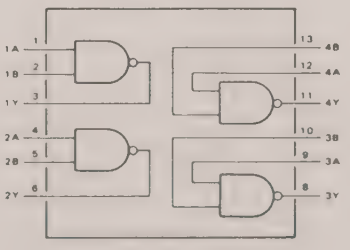

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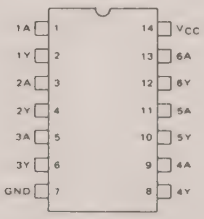

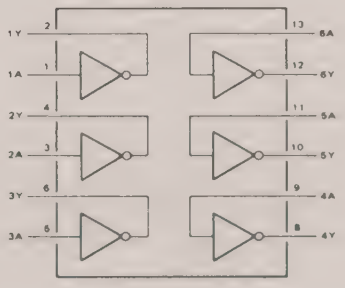

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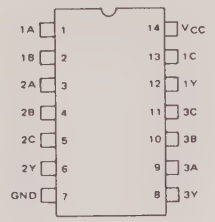

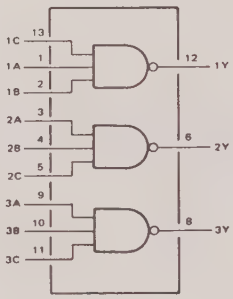

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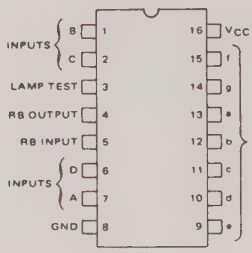

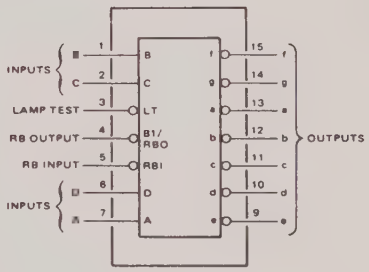

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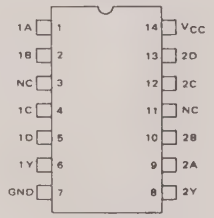

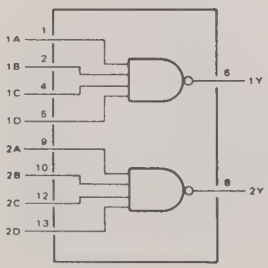

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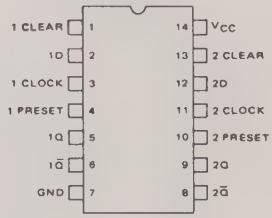

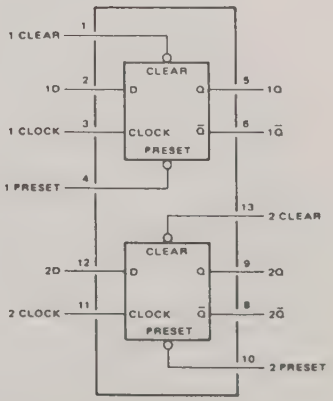

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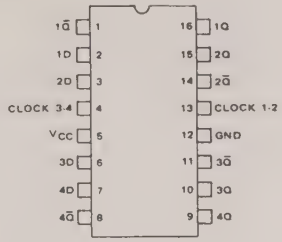

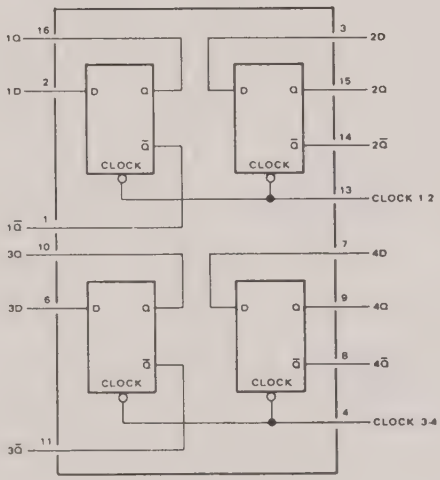

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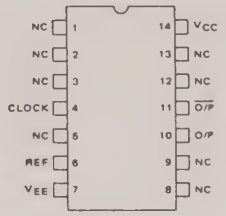

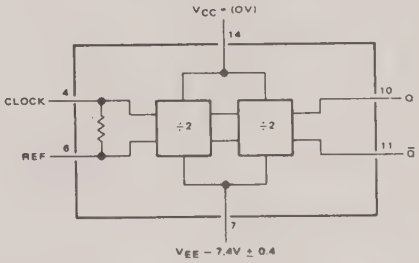

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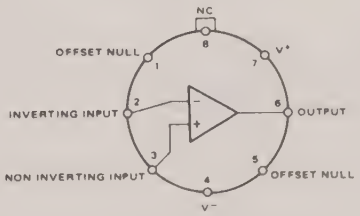

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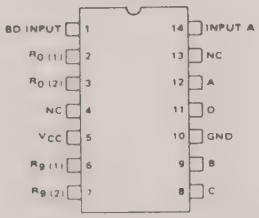

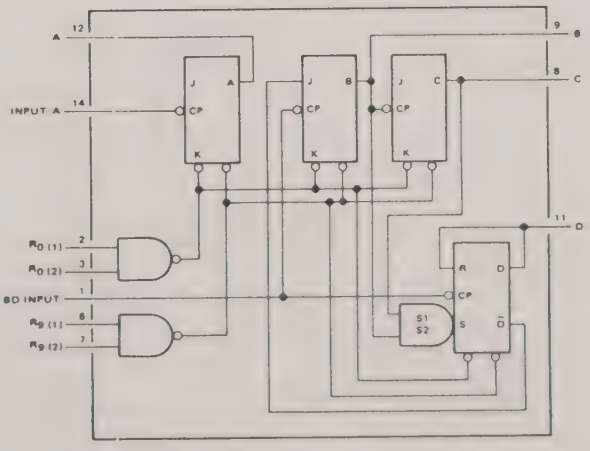

DANA U.S. AND CANADIAN SERVICE CENTERS

AUTHORIZED SERVICE CENTERS

(1) **BALL BROTHERS RESEARCH CORP**
P.O. Box 1062
Boulder Industrial Park
Boulder, Colorado 80302
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(2) **DMA ENGINEERING SERVICES**
14235 Proton Road
Dallas, Texas 75240
Telephone: (214) 661-0300
TWX: 910-860 5483

(3) **HONEYWELL, INC.**
5558 Port Royal Road
Springfield, Virginia 22151
Telephone: (703) 321-8356

(4) **AMPOWER ELECTRONIC INSTRUMENT CO., INC.**
500 Union Blvd.
Totowa, New Jersey 07512
Telephone: (201) 742-3215

(6) **PIVAN SERVICE**
3535 Peterson Avenue
Chicago, Illinois 60659
Telephone: (312) 539-4838
TWX: 910-221 0177

(7) **BROWNELL-ELECTRO**
3020 Commerce Way
Atlanta, Georgia 30354
Telephone: (404) 762-5181

(8) 307 27th Street
Orlando, Florida 32806
Telephone: (305) 843-6775

(9) 5141 Belhaven Blvd.
Charlotte, North Carolina 28216
Telephone: (704) 394-4341

(10) 3053 Tranquility Drive
Memphis, Tennessee 38116
Telephone: (901) 332-9258

(11) 1050 Acorn Drive
Nashville, Tennessee 37210
Telephone: (615) 889-8230

(12) 3450 Armour Drive
Mobile, Alabama 76607
Telephone: (205) 479-8581

(13) **STAUS ENGINEERING**
1900 Tyler Avenue, Unit 26
South El Monte, California 91733
Telephone: (213) 442-3634

(14) **VALLEY INSTRUMENT COMPANY**
491 Clover Mill Road
Exton, Pennsylvania 19431
Telephone: (215) 363 2650

(15) **VIKING LABS, INC.**
440 Bernardo Avenue
Mountain View, California 94043
Telephone: (415) 969 5500

(16) **SSCO STANDARDS LABORATORY**
8720 Northend Avenue
Oak Park, Michigan 48237
Telephone: (313) 398 2100

(17) **CANADA**

ASSOCIATED TEST EQUIPMENT LTD
3530 Pharmacy Avenue
Scarborough, Ontario M1W 2S7
Telephone: (416) 497 2208
TWX: 610 492 0122

FACTORY SERVICE LOCATIONS

(A) **DANA LABORATORIES, INC.**
2401 Campus Drive
Irvine, California 92664
Telephone: (714) 833-1234

(B) **DANA NEW ENGLAND**
591 North Ave., Door 3
Wakefield, Massachusetts 01880
Telephone: (617) 246-1590

PRODUCT SERVICE TWX 910-595-1539

DANA

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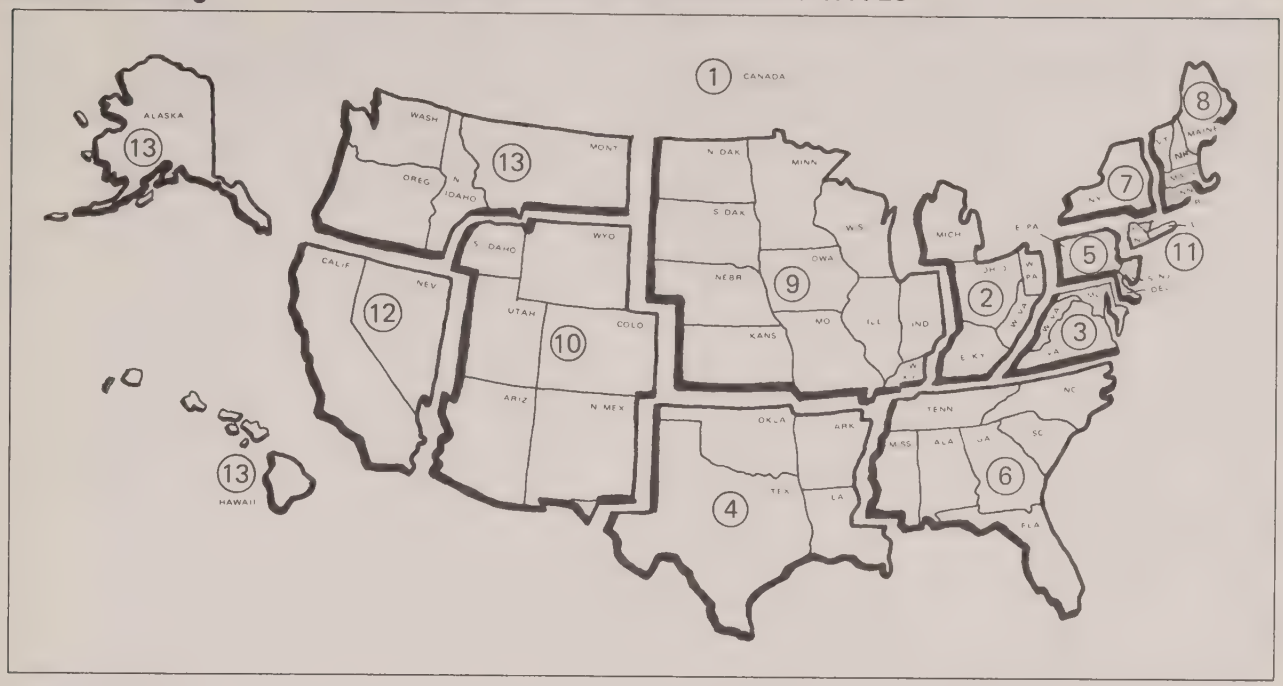

1 ASSOCIATED TEST EQUIPMENT LTD.

3530 Pharmacy Avenue
Scarborough, Ontario, MIW 2S7,
Telephone: (416) 497-2208
TWX: 610-492-0122

1320 Carling Avenue
Ottawa, Ontario, KIZ 7K9
Telephone: (613) 728-3717
TWX: 610-562-1930

3300 Cavendish Blvd., Suite 610
Montreal, Quebec H4B 2M8
Telephone: (514) 481-7733
TWX: 610-421-4443

6155 - 80th Street
Edmonton, Alberta T6E 2W8
Telephone: (403) 465-9474
TWX: 610-831-1842

1037 West Broadway, Suite 303
Vancouver, B.C., Canada
Telephone: (604) 734-2012

2 CARTER, McCORMIC & PEIRCE, INC.

23995 Freeway Park Drive
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TWX: None

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